S. HRG. 99-480

SATELLITE INSURANCE AND SPACE COMMERCIALIZATION

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, TECHNOLOGY, AND SPACE

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

ON

SATELLITE INSURANCE AND
SPACE COMMERCIALIZATION

NOVEMBER 7, 1985

Printed for the use of the
Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE
57-557 O WASHINGTON : 1986

57-557 O - 86 - 1

5261-21

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SATELLITE INSURANCE AND SPACE COMMERCIALIZATION

THURSDAY, NOVEMBER 7, 1985

U. S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE,
Washington, D. C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in Room SR-253, Russell Senate Office Building, Hon. Slade Gorton (Chairman of the subcommittee) presiding.

Staff members assigned to this hearing: Pete Perkins, professional staff member and Marty Kress, minority professional staff member.

OPENING STATEMENT BY SENATOR GORTON

Senator GORTON. Welcome to this hearing of the Subcommittee on Science, Technology, and Space as we consider the current and projected status of the space insurance market and its effect on commercial space activities.

By now, everyone is well acquainted with the vents that have led up to this hearing. The press has reported on a regular and continuing basis about the predicament that satellite insurers and satellite operators now face—rising insurance rates and shrinking insurance capacity.

The purpose of this hearing is to ascertain how the current and furutre insurance market will effect satellite development and commercial space endeavors. The subcommittee will also consider what changes, if any, the satellite operators and manufacturers and the insurance industry might adopt to relieve some of the current market pressures.

Finally, the subcommittee will examine if Government intervention is warranted at this time and, if not now, under what circumstances it might be warranted as a "back-stop." One might draw an analogy between the current insurance dilemma and that of an individual who is suffering from some ailment. As we all know, the human body has some amazing restorative and therapeutic capabilities of its own, and often these "internal' responses are all that are needed to cure the ailment. Sometimes, however, the ailment is more severe and medicinal or other forms of "external" therapy are necessary.

Whether the insurance industry's current "ailment" requires any therapy other than what the insurance and satellite industries can generate from within remains to be seen. If stronger medicine, or Government intervention is warranted, then we should certainly be mindful of any undesirable side-effects such intervention might induce.

Of particular interest to this subcommittee is the effect that the current insurance situation could have on entrepreneurs who are attempting to enter the high-risk field of space commercialization. The public good associated with the commercial development of space is a goal we should keep in mind throughout the resolution of this issue.

We have a number of distinguished guests here today who will provide the subcommittee with valuable insight into this issue. We look forward to their testimonies in the hope that the different ideas and options mentioned here today may begin to coalesce towards the successful resolution of this issue.

Senator Hollings has provided some prepared remarks and they will appear in the record.

[The statement follows:]

OPENING STATEMENT BY SENATOR HOLLINGS

Mr. Chairman, today the Subcommittee on Science, Technology, and Space is conducting a hearing that hopefully will give the Members the "state of the industry report" for the space insurance industry.

As the Members of the Committee and users, brokers, insurers, and manufacturers in the industry know, the Subcommittee has long been interested in this issue and is pleased to have commissioned the timely Congressional Research Service report on this issue. Entitled "Insurance and the Commercialization of Space," the CRS report has become the "primer" on this issue.

Today's hearing on the space insurance industry is another in a series of hearings the Committee has conducted on the overall health and state of the insurance industry. This year alone, the Committee has looked at insurance issues pertaining to product liability, motor carriers, fishing vessels, and now space insurance.

As several of the witnesses have indicated in their prepared statements today, the concerns and problems that we will hear about today are not isolated to the space insurance industry. Rather they encompass the entire property/casualty insurance industry, which is experiencing the worst period in its history.

In days of old, such a situation may have resulted in a new "government as insurer of last resort" program. Today, new federal programs are few and far between. However, this does not mean that government is incapable of minimizing risks or proposing solutions to market disruptions.

Today's hearing is intended to give the Members a status report on the space insurance industry and its effect on commercial space industries. It also is meant to give the Committee an opportunity to hear what adjustments are being made by the manufacturers, users, brokers, underwriters and launchers to ameliorate the current disruptions in the marketplace.

I look forward to today's hearing and the testimony of our distinguished witnesses. I especially would like to greet Messrs. D'Allest of Arianespace and O'Brien of NASA, who are testifying before the Committee for the first time. The mere fact that Arianespace, NASA, and DOT have agreed to appear on the same panel reflects the seriousness of the current situation in the space insurance industry.

Mr. Chairman, finally I would like to compliment you for your continued interest in this issue and in the general well-being of the commercial space industry.

Thank you.

Senator GORTON. With this in mind, I welcome the first panel of witnesses—Mr. John O'Brien, General Counsel of NASA, Ms. Jennifer Dorn, Director of the Office of Commercial Space Transportation of the Department of Transportation, and Mr. Frederick D'Allest, Chairman of arianespace.

I regret to inform you in advance that sometime shortly after 10 o'clock, the Chairman will be called to a mark-up of the Indian Affairs Committee, which will cause a supension of this hearing, unless we have the good fortune of getting another member to come by that time.

I would be grateful if each of you would try to limit the length of your opening statement. Your written statements will, of course, be included in the record, in full.

Mr. O'Brien, we will begin with you.

STATEMENTS OF JOHN E. O'BRIEN, GENERAL COUNSEL, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION; JENNIFER DORN, DIRECTOR, OFFICE OF COMMERCIAL SPACE TRANSPORTATON, DEPARTMENT OF TRANSPORTATION; AND FREDERICK D'ALLEST, CHAIRMAN, ARIANESPACE, INC.

Mr. O'BRIEN. Good morning, Mr. Chairman. It is certainly a pleasure for me to be here this morning following the very successful shuttle mission, as you know, and I think that that is an important consideration with regard to the overall subject matter we are discussing here this morning.

I am also very pleased to have this opportunity to share with you NASA's views of the current situation facing the world-wide space community as they pertain to satellite insurance and related issues.

We are all acutely aware that the international insurance industry has suffered substantial losses in the casualty insurance arena over the last 18 to 24 months. Some of these losses, but certainly not all have been attributable to certain space activities undertaken by members of the international community.

In addition, many of the insurance problems also involve the extraordinary number of aircraft accidents and other casualty losses associated with product liability and related liability pay-outs which have occurred within a relatively short period of time. As a result, the allocation of risk between manufacturers of various technologies, the users and consumers of such technologies, and the insurers and re-insurers of such ventures, have resulted in a real or perceived imbalance of risk-taking to the apparent detriment of the insurers at this particular point in time.

The reasons for this are certainly complex. However, one thing is sure and I believe that is that the insurance community world-wide is somewhat exasperated at being the risk takers of last resort when it comes to what perhaps by now should be routine space activities.

I think it is easy to by very sympathetic with this exasperation, but I think we, at the same time, must keep in perspective that this is certainly the nature of the business. There are good times and there are bad times in the insurance world. At this particular point in history, we are witnessing some bad times. Hopefully, that will improve and the pendulum will swing back in favor of good times once again.

Although we amateurs, and I consider myself an amateur in the insurance world, may be prone to panic under the current conditions, I venture to speculate that the professionals in the business, from whom you are going to hear today, know precisely the situation that they face and, importantly, have innovative and productive ideas as to how to recover from the current unfavorable circumstances. It may take a little time, I don't profess to know how long, but it is my belief that these ideas will emerge in time. These innovations will surface and I think it would behoove us all to allow this to germinate over a period of time.

Mr. Chairman, there will be pressure, I believe, to substitute the Treasury of the United States for the international insurance industry as the so-called "insurer of last resort." The exhortations in support of this pressure will be that the lack of certain forms of insurance will impede, if not retard or halt, future commercial uses of outer space.

This is, of course, cause for concern because of our mutual goal of facilitating private enterprise entry into space. At the same time, I believe that it is premature to consider legislative remedies or a role for the Federal Government to play, if any, in replacing traditional property insurance provided by the private sector.

The deliberations over this issue must take into account a number of interacting policies, circumstances and events. For example, we should keep in mind clearly, I think, that none of the incidents contributing to the unfavorable insurance situation are attributable to the space shuttle; in fact, our recent retrieval and repair missions argue in favor of shuttle operations as helping to alleviate a portion f the insurance problems once these capabilities are fully recognized and capitalized upon.

Also of importance is the fact that the only insurance in question at the present time is property insurance; that is, the insured value of commercial property. In our view, the recent history of the space insurance industry does not provide a basis for calling upon the taxpayers of the United States to underwrite the risks associated with these commercial property investments through public insurance.

This is especially true when it has not yet been clearly demonstrated that the private sector is unable or unwilling to assume these financial risks. Furthermore, I believe that the American public is attuned to the general proposition that the Federal Government should not compete with the private sector where the private sector is equipped to do the job. I maintain that the international private sector is equipped to provide the requisite satellite insurance.

These policy issues are, to be sure, very significant and legitimate. Likewise, however, in assessing whether the U.S. Government should interdict or overlap a traditional private sector prerogative, consideration should be given to what the Federal Government has already done to facilitate commercial uses of the space medium through Government sponsored risk reduction.

As you are aware, Mr. chairman, NASA has played a leading role in the allocation of risks in commercial space ventures between the public and private sectors. Over a period of time, we have attempted to remove various impediments to commercial uses of space. Because of

our joint concern here today over insurance issues, however, I will not touch on the more familiar areas of what we have enabled through our Joint Endeavor Agreements and associated agreements which, as you know, have cut through bureaucratic red-tape to encourage the private sector to undertake meaningful first steps in the commercial use of space.

Let me briefly refresh our collective recollections on what NASA, with the assistance and the understanding of the Congress , has already done to alleviate many risks which would otherwise probably require insurance coverage.

You will recall that with respect to small, self-contained payloads, or as we refer to them, "get-away specials," we totally relieve the experimenters of any liabilities to others. They are covered by our cross-waiver policy and we indemnify them against all third-party liability. This enables participation in space experimentation and applications by the "little guys," the student experimenters, the teachers, the professors, and the universities on a basis which frees them from liability concerns. The only risk these experimenters assume is the value of their experiments which, by their nature, are not high dollar value property interests.

On a more generic basis, you are familiar with our across-the-board cross-waiver policy. Under this policy, every user on board an STS flight agrees to forego any claim against any other participant on the same flight for damage to its property during the mission. This includes NASA, as well as any STS user. The net effect is to eliminate the need for insurance against claims for damage caused by a user to any participant on the same mission. Most importantly, it protects the user from the most costly of all potential liabilities, the possibility of damage to or total loss of the space shuttle, itself.

With respect to third-party liability, the Congress added Section 308 to the Space Act of 1958 which authorizes NASA to indemnify users of the STS against claims by third parties resulting from launch, operations, or recovery of space vehicles. The NASA implementation of that authority has resulted in a very satisfactory combination of insurance which is purchased by STS users against third-party liability at reasonable premiums and NASA indemnification of the users over and above the insurance coverage.

Mr. Chairman, the point to be made here is that the Federal Government has already allocated the risks of space flight in a way which should serve the commercial uses of space very well. Should the Federal Government conduct further excursions into the risk allocation arena resulting in Government insurance of commercial property interests, a substantial question arises whether commercial use of space is really mature at this time, or whether space ventures, albeit christened commercial in nature, are really Government ventures, or quasi-Government ventures, masquerading as commercial ventures. Transfer of the remaining significant risks to the Federal Government casts serious doubt on the commercial nature of these undertakings.

We at NASA are keenly aware and mindful of these issues and the potential impact that they have on U.S. policies regarding early additional usage of space for commercial purposes. Although we don't believe, firmly don't believe, that we are a major contributor to the current insurance problem, we desire to be a part of the solution to the extent we can. Accordingly, we will undertake a further evaluation of our risk allocation policies and revise them to the extent it is feasible to do so within our existing authority.

Hopefully, this can be done in such a way as to complement whatever solutions are proferred by the private sector. Exactly what shape and form this will take is not immediately apparent.

Mr. Chairman, all of this requires serious thought and consideration. In our view, it is too early to judge the ultimate reaction of th insurance underwriter, broker, manufacturer, and user communities to the recent unfortunate losses. Whether or not there is a need for additional Governmental involvement is not clear to us at this time. Adequate reaction time within the insurance industry and the manufacturing and user communities is certainly desirable and appropriate.

I believe that they are entitled to assess where they are at and where they are headed. In my view, they will do so in due course and do so on an intelligent and reasoned basis.

Mr. Chairman, that concludes my prepared remarks and I will be available to answer any questions.

[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS

COMMERCIAL USE OF SPACE: INSURANCE IMPACTS

Question 1. Does NASA currently have the authority to insure space activities? To what extent does this authority exist, and what is the statutory basis of this authority?

Answer 1. NASA currently has limited authority to either provide liability insurance to its users or to indemnify its users and contractors against third party liability. NASA currently has no authority to insure the property of a user or contractor other than in the third party liability context.

Under Sec. 308(a) of the Space Act of 1958, as amended (42 U.S.C. 2458b(a)), NASA can provide liability insurance for any user of a space vehicle to compensate all or a portion of claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle. NASA appropriations can be used to purchase the insurance, but such appropriations are to be reimbursed to the maximum extent practicable by the users.

Section 308(b) of the Space Act of 1958, as amended, allows NASA in any agreement between NASA and a user of a space vehicle to provide that the United States will indemnify the user against claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle but only to the extent that such claims are not compensated by liability insurance of the user. NASA may limit this protection to claims resulting from other than the actual negligence or willful misconduct of the user. Furthermore, NASA must, prior to extending any such protection to a user, take into account the availability, cost and terms of liability insurance otherwise available to the user.

With regard to NASA contractors, as opposed to users of a space vehicle, NASA is authorized to provide by contract that the United States will hold harmless and indemnify the contractor against specified claims or losses whether resulting from the negligence or wrongful act or omission of the contractor or otherwise. However, this authority is limited in at least two significant ways: funds in excess of available Agency appropriations to pay the government's obligation only apply to claims or losses arising out of or resulting from risks that the contract defines as unusually hazardous or nuclear in nature; and, such actions must be deemed to facilitate the national defense. See 50 U.S.C. 1431 and Executive Order No. 10789 as amended.

Question 2. Does the existing insurance dilemma adversely affect commercial space activities within NASA? What steps has NASA taken recently to reduce the level of risks associated with the shuttle?

Answer 2. It is premature to state conclusively what impact, if any, the current insurance situation may have on commercial activities within NASA. To date we have seen one communication satellite launched without insurance because they (RCA) declined to pay a rate approaching 30%. Instances like this together with the exceptionally good shuttle launch record should significantly moderate any potential negative impact upon NASA to a level that in the long run will more than likely be difficult to discern. We believe the industry as a whole will find ways to overcome the current insurance "dilemma" such that economically viable commercial space activities will succeed.

Prior to the current set of circumstances NASA had instituted numerous actions to minimize the risk associated with shuttle launches. Foremost, the design criteria of redundancy and over design of critical systems associated with "manrating" has resulted in 23 fully successful shuttle launches for a 100% success record. Beyond this basic design philosophy NASA has also provided from the outset of the program a free relaunch in the event of a NASA caused failure. In addition, NASA has participated in reviews of upper stages that are used by satellites deployed from the shuttle. We expect NASA will continue activities like these that are intended to minimize any shuttle related risks.

Question 3. In light of the success NASA has had in retrieving, refueling and repairing space science and communications satellites, why is the insurance spread rate between the shuttle and Ariane small, if not negligible?

Answer 3. While the experience to date strongly suggests that insurance rates should favor lower premiums for payloads launched on shuttle, we conjecture that there are at least two factors that are responsible for the nearly similar Ariane and shuttle insurance rates. The high loss ratio of the space insurance industry mitigates against large differences between launch systems. Secondly, the relatively small number of satellite launch experiences could be viewed as not yet providing a

statistically significant basis for large differences. We at NASA believe that with additional experience overtime, the inherent reliability of the shuttle coupled with its unique capability for recovery and repair operations will result in shuttle launched payloads benefiting from lower insurance rates.

Question 4. What obstacles exist to the sale of the retrieved statellites Palypa B2 and Westar 6? Does this affect the insurance launch level?

Answer 4. Beyond the apparent low market demand for satellites like Palypa B2 and Westar 6, NASA is not aware of any specific obstacles.

INSURANCE MARKET/CAPACITY

STATEMENT A. Commercial space activities represent a significant growth industry by the year 2000 and will improve the quality of life of all mankind.

Response. In my view this is essentially a corect view of the future. Whether or not the significant growth will be accomplished by the year 2000 is problematical. Clearly, however, such growth is bound to come in time and equally clear, I believe, is that the quality of life of mankind is bound to improve as a result.

STATEMENT B. There are particular actions governments can undertake, short of acting as insurer of last resort, that could reduce the risks associated with commercial space activities.

Response. One of the primary actions would be to assure reliable launch systems. In addition to providing a reliable launch system in the space shuttle, NASA has already done a number of things which contribute to risk reduction such as requiring cross-waivers, indemnifying shuttle customers against third party liability in excess of insurance coverage, and provision for reflight guarantees. Further, the demonstration of retrieval and repair on orbit capabilities by NASA should have a significant effect on risk. Beyond that, the Executive Branch currently has an interagency working group identifying additional potential impediments to commercial usage of space. This working group is expected to complete its work on this project in early 1986.

STATEMENT C. The lack of capacity in the insurance industry and the inability of the industry to provide coverage in a timely manner is a severe impediment to commercial space activities.

Response. It is not clear that this is the case. It is certainly conceivable that availability of insurance and the rate decision-making process. Whether this will be a dominant factor cannot be forcast at this time. There are many variables which will affect decisions and the mix of variables will differ between commercial entities depending upon their individual circumstances and the nature of the enterprise under consideration.

STATEMENT D. The insurance market poses a more difficult problem for small, mid-sized and new start firms than for established aerospace firms.

Response. Again, there are many variables associated with the decision-making process, insurance undoubtedly being one. The degree of importance of the insurance variable will vary with circumstances. It may well be that this is one of the more important considerations for small, mid-sized and new start firms. The impact will depend upon the state of the insurance market at the time decisions are being made.

STATEMENT E. From time to time, there could be a temporary government role in the space insurance industry.

Response. It is assumed that the space insurance industry referred to involves property insurance and not third party liability insurance since the latter does not appear to be a problem at the present time. In my view the government should not become involved in providing property insurance in competition with the private sector. There is no compelling demonstrated need for such intervention by the government. Any government-provided insurance would constrict the base available for the insurance industry to spread premiums and thus recover from unprofitable periods. Such an approach could well further exacerbate the current difficulties faced by the industry.

STATEMENT F. In light of your above comments, the preferred launch vehicle is:

Response. A multiple-payload reusable vehicle such as the shuttle. The space shuttle has proven its reliability in providing successful access to space and remarkable capabilities to retrieve and return payloads or repair them on orbit. This is primarily due to the presence of human participants. Not only are reliability requirements more stringent due to the manned presence, but also, man provides the means to accomplish repair, retrieval, and return operations in space. Proponents of any other launch system cannot make the same statement.

Senator GORTON. Ms. Dorn.

Ms. DORN. Thank you, Mr. Chairman. The Office of Commercial Space Transportation sincerely appreciates the opportunity to come before you today and I certainly share the views of my colleague, Mr. O'Brien, from NASA, with respect to the appropriateness of Government involvement in this insurance arena.

I would like to take just a few moments to highlight for you how we see this impact on the development of the commercial space transportation business in America.

Anyone involved clearly in commercialization of space or interested in its future cannot help but be concerned about the severe losses the space insurance industry has sustained as a result of the launch coverage it has written for communications satelittes.

Because of the Department of Transportation's regulatory and public safety responsibilities, we do follow closely the developments in the insurance industry and gauge continually their effect on the performance of industries within our jurisdiction. In fact, Mr. Chairman, the Department has recently established an internal insurance task force to assess and monitor the impact of insurance problems on the nation's transportation industries across the modes, whether we are talking about aviation, maritime or space. Included in that, of course, is the motor carrier issue, as well.

Many of these areas across the board are facing serious problems which we are monitoring and assessing on a continued basis.

Certainly transportation is a hard-hit industry. It is not the hardest hit industry. So, in the context of our discussion of space insurance, we need to, I believe, put it in a larger framework in order to determine what types of activities will be successful on the part of the private sector.

We are, then, equally concerned about insurance for commercial space ventures. In discussing the insurance problem facing commercial space industries, there is need I believe, for careful definition of our terms of reference. The insurance losses that have occurred to date have resulted from failure of expendable launch vehicles, from failure of upper stages designed to place payloads in orbit, and from on-orbit satellite malfunctions.

But they have also resulted, according to many insurers from faulty assessments of the risks involved in insuring the launch and operation of commercial satellites.

While launch vehicles can fail, insurers have long had experience with many of the vehicles or vehicle types currently utilized to place payloads in orbit. Existing US ELVs, Delta and Atlas Centaur, for example, have had reliability ratings in excess of 95 percent over the past decade. Failure of a certain percentage of launch vehicles is the kind of catastrophic loss insurers can anticipate in quoting rates and are not considered, in fact, extraordinary.

Satellite failures present underwriters with a number of uncertainties, however, exascerbated by the fact that the precise reason for satellite loss usually cannot be determined unless the satellite can be retrieved.

Such concerns about satellite performance are at the route, I believe, of demands that we are currently hearing from the insurance industry, and from the satellite manufacturers, that satellite manufacturers must either self-insure or bear a significantly higher portion of the risk.

Launch insurance underwriting capacity appears to be constrained primarily for launches involving multiple payloads. And here is a slight distinction between the domestic ELV industry problems and the problems that other launching vehicles would face. A number of brokers and underwriters in the United States and in London estimate that under present circumstances there is approximately one hundred million dollars available, world-wide, for a single launch, regardless of the number of commercial payloads on that launch.

Recent losses have been in the range of $85 to $100 million for a single satellite. At that rate, the current estimated capacity of $100 million would be insufficient to cover the launch and the full value of each commercial satellite scheduled for particular multi-payload launch.

On the other hand, an owner whose satellite is to be launched on a dedicated launch vehicle may not encounter the same obstacle.

As members of the subcommittee are aware, however, several underwriters are now expressing considerable reluctance to provide coverage for the ascent to orbit and initial operations phase of satellite launches. If this approach should become standard industry practice, it would impact dedicated and multiple launch programs equally.

Provided coverage for these launch phases remains available, the satellite owners utilizing dedicated launches on vehicles with proven reliability should still be able to obtain launch insurance coverage even if maximum capacity remains reduced to the levels currently anticipated.

In the case of dedicated launches utilizing unproven vehicles, we believe that while rates for insurance coverage may increase, the total amount of coverage needed is likely to be lower Newer commercial launch systems are projected to be less expensive and launch coverage needed for them does not appear to rise to the levels impacted by current capacity constraints, as envisioned by the industry.

Concern has also been expressed that third-party liability coverage either may be no longer available, or may be available only at substantially higher rates. At present, liability insurance premiums constitute a very small percentage of total launch cost, and they do not appear, Mr. Chairman, to present a barrier to commercial launch ventures in our view.

The capacity of underwriters to provide such insurance may depend, to some extent, on the launch vehicle and on the number of payloads to be launched from that vehicle.

Third-party liability is an insurance line quite distinct from other forms of space insurance. Indeed, a number of underwriters will provide third-party liability coverage but will not write launch insurance, and vice versa. For this reason, and also because the liability insurance market, overall, is a large one, with internal dynamics of its own, losses in one line of space insurance do not seem to have a direct and immediate effect on the availability of third-party coverage.

In my view, the present situation does not warrant any form of intervention by the U.S. Government in private insurance markets. While insurance for space ventures remains crucial to their commercial success, I believe that any such Government action would be both premature and unwise.

Our examination of the space launch and liability insurance industries, including numerous discussions with brokers and underwriters in both the U.S. and in Europe, has served to reinforce this belief. I also share the apprehension of private ELV companies, that U.S. Goverment involvement in space insurance could work to their competitive disadvantage.

As mentioned earier, launch insurance does not seem to be a problem for dedicated launches, for which ELVs are especially well-suited. Were the Government to intervene in order to alleviate insurance capacity problems affecting multiple payload launches, effectively to the detriment of dedicated launches, such a policy would further discourage space launch commercialization efforts.

The objective in all cases would have to be to ensure that any measures the Federal Government were to implement would affect all U.S. launch systems equally.

In summary, Mr. Chairman, I think the appropriate role for the Federal Government should be continue to monitor carefully the present situation in the insurance and satellite industries, rather than to try to direct market forces in particular ways. Consistent with that philosophy, the Department of Transportation recently established the Internal Task Force, which I have mentioned to you. We are also responsible as Chairman of an interagency group, to look at space commercialization—in particular, this is under the context of Secretary Baldrige's Commercial Space Working Group.

We look forward to working closely with the subcommittee and will certainly keep you aprised of our efforts on these and other matters influencing the success of commercial space ventures.

Thank you, so much.

[The statement follows:]

STATEMENT OF JENNIFER L. DORN, DIRECTOR, OFFICE OF COMMERCIAL SPACE TRANSPORTATION, DEPARTMENT OF TRANSPORTATION

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear before the Subcommittee today concerning the issue of insurance for commercial space endeavors and for your continuing interest in matters affecting the commercial space launch industry.

My remarks this morning are directed, at the Subcommittee's request, to the impact that constraints on space launch insurance underwriting capacity may have on the U.S. private commercial launch industry and its customers. As members of the Subcommittee are well aware, there is considerable concern that the communications satellite industry and possibly other commercial space ventures many soon be facing sharply increased premiums for launch insurance and that some may be unable to obtain such insurance at any price. The projected shortfall in capacity is a direct result of the recent series of losses due to launch or satellite failure. My testimony addresses the nature and scope of the problem as well as some of its implications for the continued growth and development of commercial space industries.

The Office of Commercial Space Transportation has a direct interest in space insurance for two reasons. First, the Commercial Space Launch Act directs the Secretary of Transportation, in issuing licenses for the launch of commercial launch vehicles or the operation of private launch sites, to establish minimum levels of liability insurance coverage that operators must obtain. Coverage must be sufficient to ensure that "third parties" (persons and property not involved in a launch or launch site operation) can be compensated for any damages they might sustain as a result of launch activities. Liability insurance coverage has added significance in that the United States itself could be held liable under international law for damage caused to foreign nationals by privately launched U.S. spacecraft. On May 7th, the Office of Commercial Space Transportation initiated a rulemaking proceeding to establish the procedures and criteria it will utilize in making these determinations, Thus, we are concerned that capacity remain available, at reasonable rates, to enable licensees to meet the third party liability insurance requirements that are established for launch operations.

Second, the Act directs the Secretary to "encourage, facilitate, and promote" commercial space launches by the private sector. An essential element of any commercial launch is business insurance coverage (for loss as well as for liability) to protect investor capital. For this reason, the Office is concerned with the extent to which other types of insurance coverage required for commercial space ventures—prelaunch, launch, and on-orbit "satellite life" insurance—continue to be available to launch customers.

Anyone involved in space commercialization or interested in its future cannot help but be concerned about the severe losses the space insurance industry has sustained as a result of the launch coverage it has written for communications satellites. Depending upon the final claims settlements in connection with the losses of the GTE Spacenet 3 and the Eutelsat-ECS 3 satellites due to the failed launch of an Ariane 3 last month, the insurance industry will have paid in excess of $850 million in claims since 1977. Of this moment, approximately $600 million will have been paid as a result of losses occurring within the last twenty months. Even the steep increases in rates that have occurred as a result of these failures (from about 7.2% in 1977 to as high as 20% or even higher in the current market) may not generate premium revenues sufficient to enable underwriters both to recoup payouts for past claims and to continue underwriting future space ventures of similar magnitude.

Insurance is a factor critical to the success of commercial ventures. It is especially important to space ventures, which expose substantial investment capital to risk of loss in a single event. Representatives of the financial community have stressed that, were insurance not available, the private investor capital needed to support space commercialization efforts would evaporate. Thus, the issues of launch insurance capacity and rates will continue to be matters of keen interest until the extent of the problem is fully evaluated and appropriate initiatives for resolution have been thoroughly explored and pursued.

NATURE OF CURRENT SPACE INSURANCE CAPACITY PROBLEMS

When considering the problems facing commercial space ventures in the insurance market, it is important to bear in mind that underwriting losses—and concomitant capacity reductions coupled with sharp premium increases—have by no means been confined solely to space insurance lines. The entire property/casualty insurance industry is presently experiencing the worst period in the history. According to a recent authoritative study by the Insurance Services Office, Inc., and the National

Association of Independent Insurers, net losses totaled $1 billion in 1980 and almost $18 billion in 1984. These losses were caused by an unbroken string of underwriting losses since 1979. In 1984, underwriting losses reached more than $21 billion; the six year total came to $55 billion. And the commercial property/casualty lines have fared worst of all.

While insurance is primarily a contractual issue between an insurance provider and a purchaser, and regulation of insurance is primarily a function performed by state governments, the Department of Transportation has responsibility in a number of insurance areas. Both the Federal Aviation Administration and the Maritime Administration manage war risk insurance programs. The Federal Highway Administration administers the statutory minimum levels of financial responsibility required by the Motor Carrier Act of 1980 and the Bus Regulatory Reform Act of 1982. The Coast Guard enforces the minimum insurance requirements for vesseel operators under the Federal Water Pollution Control Act.

Because of the Department's regulatory and public safety responsibilities, we follow closely developments in the insurance industry and gauge continually their effect on the performance of industries within our jurisdiction. The recent insurance losses industry-wide have placed additional cost pressures on a number of transportation modes.

Insurance is presently a critical issue in commercial aviation, for example, and has been a subject of intense concern even prior to the series of accidents we have witnessed in recent months. By the first quarter of this year, passenger liability insurance rates for the major and national carriers had risen an average of more than 41% above first quarter 1984 rates, and rates for "hull insurance," or aircraft physical damage coverage, had risen more than 28%. I want to emphasize that these increases do not reflect the recent losses, whose effects on rates are not yet known. It is widely expected, however, that airlines will face significantly higher deductibles and may be unable to retain the levels of coverage they now have.

Urban mass transit is another transportation mode encountering significant insurance difficulties. This past July, the Southern California Rapid Transit District came within nine hours of idling its 2,500 buses for lack of insurance coverage. The annual premium rose from $67,000 to $3.2 million. Analogous situations confront other transit companies across the country, with premiums expected to increase 100-1000 percent in upcoming renewals. The Urban Mass Transportation Administration is working closely with local transit authorities and the insurance community to reach cooperative, non-regulatory solutions to the current capacity shortage. Similar problems face the trucking industry, where both interstate and intrastate trucking have been hit especially hard by dramatic liability insurance rate increases.

We are equally concerned about insurance for commercial space ventures. In discussing the "insurance problem" facing commercial space industries, however, there is need for careful definition of our terms of reference. The insurance losses that have occurred to date have resulted from failure of expendable launch vehicles, from failure of upper stages designed to place payloads in orbit, and from on-orbit satellite malfunctions. But they have also resulted, according to many insurers, from faulty assessments of the risks involved in insuring the launch and operation of commercial satellites. These underwriting misjudgments produced unrealistically low rates from the outset and proved to be a significant contributor to the current problem. The losses have caused several insurers to cease providing coverage for space launches entirely and others to reduce considerably the amounts they will write or the risks they will insure.

It is important to understand the precise nature of the risks that are being assumed by space insurance underwriters. Many in the insurance industry feel that launch insurance, as presently written, essentially constitutes a form of manufacturer's warranty. In effect, it guarantees that the satellite will perform its intended function or its insurer will pay compensation to its owner. Such compensation, depending upon the amount of coverage obtained, can equal as much as the full value of the payload, the cost of its launch, and the revenues the operator could have expected to earn had the satellite functioned as intended.

Providing insurance coverage for any single space launch is a multinational undertaking. In addition to insurance companies, pools, and syndicates in the United States and the United Kingdom, underwriters in several western European nations (in particular, France, Germany, Italy and Sweden) write substantial amounts of coverage for both NASA and Arianespace launches. Moreover, many underwriters in these countries participate in space insurance lines (as in other insurance lines) both as direct providers and as "reinsurers." Reinsurance is a key component of insurance underwriting capacity. It enables underwriters, through a series of commer-

cial agreements with other underwriters, to dilute the risks they have assumed by spreading them across broad segments of the industry.

Thus, the intricacies inherent in insurance underwriting make it extremely difficult to determine, in the abstract, precisely how much capacity exists at any given moment in any particular insurance line. Projections are especially difficult to make in lines like those in space insurance, where there is no broad actuarial base. Insurance capacity can only be known with certainty in the context of a particular launch, when an insurance broker submits, on behalf of a payload owner/operator, a request for rate quotations from "lead" underwriters and when other underwriters subsequently commit to taking a portion of the line at the rates and on the terms being offered to that customer. It is also very difficult to know whether coverage for a particular satellite, once written, has exhausted all of the capacity currently available for the line of insurance involved.

EFFECTS ON THE U.S. PRIVATE COMMERCIAL LAUNCH INDUSTRY

While launch vehicles can fail, insurers have long had experience with many of the vehicles or vehicle types currently utilized to place payloads in orbit. Existing U.S. ELVs, Delta and Atlas/Centaur for example, have had reliability ratings in excess of 95% for the past ten years. Failure of a certain percentage of launch vehicles is the kind of "catastrophic" loss insurers can anticipate in quoting rates and are not considered extraordinary. Satellite failures present underwriters with a number of uncertainties, exacerbated by the fact that the precise reason for a satellite loss usually cannot be determined unless the satellite can be retrieved. Such concerns about satellite performance are at the root of demands we are currently hearing that satellite manufacturers must either self insure or bear a significantly higher proportion of risk.

Launch insurance underwriting capacity appears to be constrained primarily for launches involving multiple payloads. A number of brokers and underwriters in the United States and in London estimate that, under present circumstances, $100 million is the maximum amount of coverage available worldwide for a single launch, regardless of the number of commerical payloads on that launch. Recent losses have been in the range of $85–100 million for a single satellite. At that rate, the current estimated capacity of $100 million would prove insufficient to cover the launch and the full value of each commercial satellite scheduled for a particular multi-payload launch. On the other hand, an owner whose satellite is to be launched on a "dedicated" (single payload) launch vehicle may not encounter the same obstacle.

As members of the Subcommittee are aware, however, several underwriters are now expressing considerable reluctance to provide coverage for the ascent to orbit and initial operations phases of satellite launches. If this approach should become standard industry practice, it would impact dedicated and multiple launch programs equally. Provided coverage for these launch phases remains available, satellite owners utilizing dedicated launches on vehicles with proven reliability should still be able to obtain launch insurance coverage even if maximum capacity remains reduced to the levels currently anticipated.

In the case of dedicated launches utilizing unproven vehicles, we believe that while rates for insurance coverage may increase, the total amount of coverage needed is likely to be lower. Newer commercial launch systems are projected to be less expensive and launch coverage needed for them does not appear to rise to the levels impacted by current capacity constraints.

Concern has also been expressed that third party liability coverage either may no longer be available or may be available only at substantially higher rates. At present, liability insurance premiums constitute a very small percentage of total launch costs and do not appear to present a barrier to commercial launch ventures. The capacity of underwriters to provide such insurance may depend to some extent on the launch vehicle used and on the number of payloads to be launched from that vehicle.

Third party liability is an insurance line quite distinct from other forms of space insurance. Indeed, a number of underwriters will provide third party liability coverage but will not write launch insurance, and vice versa. For this reason, and also because the liability insurance market overall is a large one with internal dynamics of its own, losses in one line of space insurance (i.e., launch insurance) do not seem to have a direct and immediate effect on the availability of third party coverage.

Up to the present time, insurance underwriters have been able to provide $500 million in liability coverage for each launch of a single payload. Multiple payloads launched from a single vehicle, such as the Shuttle, however, have been covered up to $750 million for all payloads launched on a particular mission. NASA assists pay-

load owners in obtaining coverage and has authority under Section 308 of the National Aeronautics and Space Act to provide coverage under certain conditions if a sufficient amount cannot be obtained commercially.

We should bear in mind that, in the twenty years since insurers first began in write coverage for commercial satellites, no claim has ever been made under any space liability insurance policy. Yet, rates for space third party liability insurance, while still comparatively low, have begun to rise along with all insurance rates in recent months. We share the view of most industry observers that these increases are primarily the result of the substantial losses that have occurred in the property/casualty insurance industry generally. While one cannot discount at least the psychological effects of losses in one line of space insurance upon other insurance coverage written for the same industry, we believe that any capacity constraints which may exist or develop in the third party liability area are more the result of these insurance industry-wide liability losses than of the recent losses in space launch insurance lines.

OPTIONS

Concerns about the continued availability of commercial insurance for space ventures have prompted a number of proposals concerning steps that the space and insurance industries, and in some instances the Federal Government itself, should take to alleviate the problems created by the current rate hikes and capacity constraints. Some of these ideas propose increased risk sharing or financial pooling arrangements among firms actively involved in space activities, including satellite owners and manufacturers as well as operators of launch vehicles. Other proposals suggest private and public efforts to promote increased exchanges of information among satellite owners, manufacturers and insurers concerning satellite design, manufacture and performance.

Some proposals, especially those contemplating government intervention to subsidize insurance premiums or actually to provide insurance, rest upon a conclusion that insurance markets have failed and that somewhat drastic action may be warranted. These proposals involve a variety of approaches. Some raise the possibility that the Government might provide insurance only for multiple payload losses which have extremely high values and which might thereby constrain overall launch insurance capacity. Others would target government subsidization of rates on the more risky phases of launches and encourage private insurers to underwrite other launch phases. It has also been suggested that the Government target insurance subsidies on certain space industries or firms, such as new space technologies or smaller satellite companies that may have difficulty obtaining insurance at affordable rates.

In my view, the present situation does not warrant any form of intervention by the United States Government in private space insurance markets. While insurance for space ventures (including projects to provide both the transportation to, as well as the means to utilize, the space environment) remains crucial to their commercial success, I believe that any such government action would be both premature and unwise. Our examination of the space launch and liability insurance industries, including numerous discussions with brokers and underwriters in both the United States and in Europe (including some no longer writing space insurance lines) has served to reinforce this belief.

I also share the apprehension of private ELV companies that U.S. Government involvement in space insurance could work to their competitive disadvantage. As mentioned earlier, launch insurance does not seem to be a problem for dedicated launches for which ELVs are especially well-suited. Were the Government to intervene in order to alleviate insurance capacity problems affecting multiple payload launches—effectively to the detriment of dedicated launches—such a policy would further discourage space launch commercialization efforts. The objective in all cases would have to be one of ensuring that any measures the Federal Government were to implement affect all U.S. launch systems equally.

To state that government intervention is not warranted is not to suggest that all is well in the insurance area. At this point, however, I believe strongly that the better policy would be to allow the insurance markets sufficient time to remedy a situation which the markets have themselves produced. While it is true that the insurance industry has incurred losses as a result of faulty assumptions, inflated revenue expectations or other reasons, the fact remains that the industry itself may well possess the means to redress current problems. Solutions may indeed lie in strategies that contemplate increased risk sharing among parties most directly involved in satellite launches with the option of enabling premiums and capacity to return to

more comfortable levels. In any event, we need to allow time for the necessary adjustments to occur.

In summary, Mr. Chairman, I think the appropriate role for the Federal Government at this stage should be to continue to monitor carefully the present situation in the insurance and satellite industries rather than to try to direct market forces in particular ways. Consistent with that philosophy, the Department of Transportation recently established an internal Insurance Task Force to coordinate information from the transportation sector and to assess and monitor the impact of insurance problems on the nation's transportation industries. In addition, the Office of Commercial Space Transportation is heading a sub-group of the Commercial Space Working Group to provide a similar focus for the space industry in particular.

We look forward to working closely with the Subcommittee and will keep you apprised of our progress with these and other matters influencing the success of commercial space ventures.

Thank you.

[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS OF MS. DORN

Question 1. The first set of recommendations generated by your Office's Commercial Space Transportation Advisory Group on 23 October 1984 and submitted to Secretary Dole included the following:

RECOMMENDATION NO. 2: LAUNCH INSURANCE

A. The Department of Transportation should analyze whether the government should provide backup launch insurance (i.e. to be an insurer of last resort) for ventures which cannot be fully insured commercially.

B. In this capacity, the government should not compete with private sector insurance nor should it take on a regulatory role."

Has your Office done such an analysis? What were the results? Has the Advisory Group or your Office taken any steps to assess the insurance issue?

Answer. Following the October 1984 meeting of the Department's Commercial Space Transportation Advisory Committee, the Office of Commercial Space Transportation undertook a preliminary analysis of the state of the launch—and third party liability—insurance markets to determine whether adequate capacity existed at reasonable rates. Based upon discussions with committee members with expertise in insurance matters and with others involved in space and space insurance ventures, it was determined that adequate insurance remained available and that government intervention appeared to be neither necessary nor appropriate at that time. The Director of the Office of Commerical Space Tranportation reported these findings to the Advisory Committee at its meeting in March 1985.

The issue of whether the U.S. Government should become involved in the provision of launch insurance was again considered following the recent satellite losses. DOT staff members representing the Office of Commercial Space Transportation conducted extensive inquiries in both the United States and London insurance markets to determine the effect of these losses on launch insurance rates and capacity. The conclusions derived from these inquiries were incorporated in the testimony given before the Senate Commerce Committee on 7 November.

The issue was again considered by the Advisory Committee at its recent meetings on 25–26 November 1985. The Committee adopted the following recommendations regarding third party liability insurance and reflight guarantees:

1. *Third Party Liability Insurance and Indemnification.*—With respect to third party liability, the Committee recommends that the Department seek enactment of legislation making those insurance and indemnification provisions applicable to U.S. Govenment launches of commercial payloads equally applicable to U.S. private commercial launches.

2. *Reflight Guarantee.*—The Committee concluded that the provision of discounted reflight opportunities by the Government for failures resulting from causes related to equipment or services not provided by the Government—apparently designed to compete in international markets—serves as serious impediment to development of the U.S. ELV industry and the recovery of the insurance market.

Question 2. Does your Office, or DOT on behalf of your Office, have the authority to act as an insurer of last resort for ELVs? What is the statutory basis of this authority?

If you do not have this authority, is it required?

Answer. The Department of Transportation has no authority to insure or to indemnify either the providers of commercial space transportation or their customers. For the reasons explained at some length in my testimony, we do not believe that present circumstances in the space or insurance industries warrant enactment of such authority. This view rests upon our observations that launch insurance for launches of single payloads (for which ELVs are especially well suited) continues to be available, that third party liability insurance also remains available at reasonable rates, and that the insurance markets are capable of recovering from the recent losses without government intervention and should be given the opportunity to do so.

These conclusions reinforce our general view that interjection of the government into private commercial transactions, even when undertaken with laudable objectives, may well hamper the insurance industry's ability to take action to ensure its own recovery and could prove impossible to reverse when such involvement is no longer required. It is also the Department's general view, however, that any intervention of the Federal Government in insurance matters must be structured in ways that impact all U.S. launch systems equally.

STATEMENT A: Commercial space activities represent a significant growth industry by the year 2000 and will improve the quality of life of all mankind.

Comment: We share the hope that commercialization will be both a successful and profitable undertaken for all involved. Although commercialization may be materializing somewhat slower than anticipated, we believe that with effective and efficient implementation of US space policies and continued interest on the part of the private sector, it will reach and hopefully surpass expectations.

STATEMENT B: There are particular actions governments can undertake, short of acting as insurer of last resort, that could reduce the risks associated with commercial space activities.

Comment: We do not believe that the current insurance situation warrants government intervention. Present government policies such as lower priced Shuttle flights for the FY 1983–1988 time period and NASA's commercialization policy including Joint Endeavor Agreements, although not directly related to insurance issues, will continue to reduce risks associated with commerical space activities.

STATEMENT C: The lack of capacity in the insurance industry and the inability of the industry to provide coverage in a timely manner is a severe impediment to commercial space activities.

Comments: Although capacity appears now to be constrained, it does not appear to be a severe impediment to commercial space activities. Certainly it is too early to determine if the current situation will continue long enough to affect future commercial space activities such as materials processing. As NASA has testified, no customers have cancelled scheduled launches due to insurance unavailability.

We believe that as the situation stabilizes with increasingly successful launches and premiums more in line with risks incurred, insurers and reinsurers will enter (or re-enter) the market. It is our understanding that efforts are currently underway by insurers and reinsurers to provide approximately $250–300 million of Shuttle in-bay insurance capacity. This insurance would cover that portion of a Shuttle launch from lift-off to release of the satellite from the bay.

STATEMENT D: The insurance market poses a more difficult problem for small, mid-sized and new start firms than for established aerospace firms.

Comment: Certainly, small and new start firms will have more difficulty financing projects if the insurance situation worsens. These companies do not have the resources of larger aerospace companies to leverage investments or self-insure some of the risk.

STATEMENT E: From time to time, there could be a temporary government role in the space insurance industry.

Comment: The insurance industry appears to be willing and able to resolve the current problems, as evidenced by its interest in providing Shuttle "in-bay" insurance. The United States is also encouraging the development of a commercial ELV industry, which typically offers dedicated launches that are not impacted by insurance capacity constraints to the same extent as multiplied payload launches.

It is inappropriate to speculate as to situations which might warrant temporary government intervention. Such speculation could seriously impact efforts by the insurance industry to alleviate current capacity constraints. It is also important to note that temporary actions, more often than not, become permanent actions, to the possible long-term detriment of the insurance situation.

STATEMENT F: In light of your above comments, the preferred launch vehicle is: (Pick one of the following and specify "Why")

1. A dedicated expendable launch vehicle (ELV)—only one payload (e.g. a Delta or Atlas-Centaur rocket);

2. A multiple-payload ELV—capable of 2 or more payloads (e.g., the Ariane Rocket); or

3. A multiple-payload reusable vehicle such as the Shuttle.

Comment: No one vehicle is the preferred launch vehicle for all customers. For customers planning to launch 2-3 years in the future, a dedicated ELV may be the vehicle of choice since it may be less affected by current insurance capacity constraints. Higher insurance premiums charged to customers that prefer or require a manned vehicle like Shuttle would probably not alter their choice of vehicle since the higher cost of insurance would be offset by the Shuttle's lower launch price (relative to US ELVs). In addition, both Arianespace and NASA offer attractive reflight guarantees at below market rates or at no cost.

Senator GORTON. Thank you, very much. Mr. d'Allest.

Mr. d'ALLEST. Mr. Chairman, I am honored to have the opportunity to testify before this subcommittee on the subject of space insurance and to offer my views on the difficult situation in this field as it has developed since February 1984.

I am the chairman and chief executive office of arianespace, a European private corporation dedicated to producing, marketing and launching, at our own risk, the ariane launch vehicles developed by the European Space Agency. I founded this first commercial space transportation company in 1980, with all of the major manufacturers and suppliers as shareholders, and today we have a free world market share of about 45 percent in commercial launch services.

We have signed contracts for 35 satellite launches in Europe, the United States, Brazil, Arab countries, Australia and for international organizations. In addition, we have several options in other parts of the world.

As a major supplier of commercial launch services in the Western world, we are vitally concerned about the space insurance situation.

As you know, in the last 21 months, six insured satellites were lost: Two, WESTAR-VI and PALAPA-B, because of shuttle perigee stage malfunctions; one, INTELSAT VA, because of ATLAS-CENTAUR expendable launch vehicle malfunction; one, LEASAT 4, because of a malfunction of the satellite safety and arming device, after deployment by the shuttle; and two, SPACENET III and ECS-3, because of ariane malfunction.

Other satellite partial losses have also occurred.

The ariane failure was the first since arianespace assumed responsibility for its production after the early ESA development flights, and after a series of nine successful flights. Although the Space shuttle itself has shown a superb reliability, its advent has not had a positive impact on the insurance market because this advantage has been offset by the complexity of its deployment of satellites into the low earth orbit, of the arming of safety devices, and of the control and propulsion of the perigee stages.

By contrast, expendable launch vehicles, like ariane or Centaur, inject their payloads directly into geostationary transfer orbit using a straightforward procedure. There is a large consensus developing, as seen from the satellite operator's point of view, interested only in overall mission reliability, that STS missions and expendable launch vehicle missions have a comparable reliability. The experience of the last 21 months supports this conclusion.

The result of these failures is that insurance losses exceed the premiums paid by a ratio of nearly two-to-one. The situation that has developed today is characterized by three main issues:

Number one, a severe shortage of insurance capacity—approximately half the needed capacity is lacking—as a number of underwriters have withdrawn from the markets; two, excessive premiums quoted for the remaining capacity following the disastrous losses incurred and following reduced competition; three, no commitments on insurance capacity or on premium levels at the time that satellite operators have to decide their investment and to provide for adequate financing.

This situation is simply unacceptable for most of the satellite operators and is actually jeopardizing the further development of the commercial space industrty. arianespace has today several customers ready to go ahead on satellite construction and launches who are stuck with this uncontrolled risk. Several recent international insurance community meetings have given no hope of a short-term recovery of the insurance market.

In the meantime, it is therefore unavoidable that temporary measures must be taken by spacecraft manufacturers, launch services suppliers, and satellite owners in order to safeguard their vital interests. As far as arianespace is concerned, we have decided to bring our contribution to the solution of this issue by offering to our customers, for the portion of the risk which is under our control. I mean, for the ariane launch phase from lift-off to satellite separation, a reflight guarantee according to the following principles:

A, to provide an additional capacity to that available in the market in order to meet, as closely as possible, the satellite operator's needs; B, to establish a program on the basis of financial balance between the premium charged and the risks incurred; C, to provide this additional capacity to satellite operators at a reasonable premium.

This is achieved by the following mechanism:

arianespace will spread the risk of a failure over a series of 15 ariane launches. arianespace will assume the risk for the first failure in this series, which corresponds to the failure rate experienced with the expendable launch vehicles—that means an approximate success rate of 93 to 94 percent. arianespace will buy reinsurance to cover the risk of unexpected additional failures within the series of fifteen ariane launches. This reinsurance will be obtained on the reinsurance market, including the French "Caisse Centrale de Reassurance."

This coverage will be available to our customers as an option when signing the launch contract and the premium will be paid in accordance with the payment schedule of the launch contract.

In order to solve completely the short-term insurance issue, we welcome any initiative such as satellite risk pooling or guarantees supplied by spacecraft manufacturers for the remaining portion of the risk related to satellite operation after separation of ariane, in addition to the insurance available on the market. However, we firmly hope that the market will recover in a couple of years, allowing the termination of such temporary measures.

We have been informed that NASA shares our concerns on the critical situation of the insurance market and has recently offered reflight guarantees. However, we question the scheme announced as it assumes a heavy subsidy on the cost of the reflight. It also includes risks related to perigee stages or satellite operations which are not under our competitor's responsibility.

As you may know, arianespace and the European Space Agency member states are pressing the U.S. Government to apply a full cost recovery for the shuttle launch services, as is the cost for our commercial company, and are denouncing the freely acknowledged and considerable subsidies included in the current shuttle pricing policy. The nature of this reflight guarantee constitutes, in our judgment, an additional distortion of the competition between ariane and Space shuttle when it appears desirable on both sides of the Atlantic to set conditions for a healthy and fair competition.

In conclusion, we note that the existence of a space insurance market has played a major role since 1968, in space commercialization. We think that the current situation of the market is dangerous and may jeopardize the development of commercial space ventures and the related space industry.

We are aware of the various ideas and initiatives which are presently being studied or decided. With this in mind, we feel confident that after a maturation, which might take some time, and through the cooperation of the insurers, the launcher and satellite manufacturers and satellite operators, the conditions for a stable, healthy and competitive insurance market will be met.

Mr. Chairman, this concludes my remarks, and I will now be happy to answer questions.

[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS

Question 1. Could you please be more explicit as to why the NASA reflight guarantee is a subsidy, while the Ariane reflight guarantee is not a subsidy?

Answer 1. Arianespace's reflight guarantee for risks during the launch phase offers a new insurance capacity at a technically reasonable premium rate of 11 to 13%, in case of a failure due to the launch service provided by Arianespace. The premium is an additional charge for the extra insurance capacity provided by Arianespace. It is designed to have an economic balance between the premium received over 15 flights and the probable losses. The statistics indicate indeed that this balance would be achieved with a premium of 9.3% for an Ariane reliability of one failure every 15 flights (in average), 10.2% for one every 12 flights, 11.2% for one every 10 flights and 11.8% for one every 8 flights.

The guarantee proposed by NASA, offering a reflight at half price in case of a failure for any reason up to 90 days after launch, including materials and services outside of NASA's control such as perigee stage, apogee stage and the satellite itself, introduces a new element of subsidy. In fact a customer of NASA will be able to reduce his launch insurance cost by 50%, while otherwise he would have to insure at market rates, currently running between 25 and 30%. This difference corresponds to an additional rebate of 12 to 15% of the initial launch price, for which the customer pays nothing. In addition, any reflight under this service will cost the NASA operating budget 50% of the launch price.

Question 2. Would it be too simplistic to say that the Ariane policy merely provides the added increment of launch insurance needed to cover the total value of the payloads?

Answer 2. Arianespace's objective is to add to the capacity available in the market which at this point is unfortunately insufficient to meet the total insurance demand during the launch phase. This is the phase during which the problem of capacity is most critical, since the principle of double launches results in an accumulation of risks. Indeed when the two satellites are separated from the launcher and put into transfer orbit, each risk becomes isolated and the problem of capacity can be more easily resolved by the insurance market.

Question 3. What does the Ariane reflight policy do for a spacecraft lost before assuming its assigned slot in the geostationery orbit and becoming operational? What does it do for lost operating revenues?

Aren't these two areas the principal concerns of the underwriters?

Answer 3. The reflight guarantee offered by Arianespace covers only those risks due to the failure of the Ariane launcher, with a very precise definition of the failure. If the satellite does not attain the correct final geostationary orbit, but has been put into the proper transfer oribit by Ariane, the guarantee does not apply. The Arianespace guarantee thus does not take into account any loss of income.

Question 4. It has been reported to this Committee that Arianespace has offered to cap the insurance cost for a prospective customer, i.e., basically buy down the rate of launch insurance up to a certain percentage and dollar limit.

Would you please advise this Committee as to the veracity of this situation and comment on your "marketing initiatives" besides the reflight program described in your statement?

Answer 4. During the early period of Ariane use, and in very particular situations, as a show of confidence in the quality and reliability of its service and the product, Arianespace did agree to share the eventual difference in rates for Ariane and the competing launch services. This was done as a pure commercial business risk, to attract customers. This confidence has been proven with time to be well founded on Ariane's launch record. Experience today shows that insurance rates for satellite launches, whether by Ariane or Shuttle, are very similar.

STATEMENT A. Commercial space activities represent a significant growth industry by the year 2000 and will improve the quality of life of all mankind.

Response. Yes, of course.

STATEMENT B. There are particular actions governments can undertake, short of acting as insurer of last resort, that could reduce the risks associated with commercial space activities.

Response. Governments should help various industries, within the framework of their research and development budgets, to improve their products with a view toward increasing the reliability of space technology. However, government as the insurer of last resort is obviously not desirable, except in extreme cases when space commercialization development would be seriously jeopardized.

STATEMENT C. The lack of capacity in the insurance industry and the inability of the industry to provide coverage in a timely manner is a severe impediment to commercial space activities.

Response. Yes, as we said in our introduction, new investors in particular cannot get started unless they can obtain financing, which is contingent on adequate insurance.

STATEMENT D. The insurance market poses a more difficult problem for small, mid-sized and new start firms than for established aerospace firms.

Response. This is true today, but in time even the large aerospace companies might be affected. One or two major mishaps for a large aerospace firm could very well have a negative impact on the stock market.

STATEMENT E. From time to time, there could be a temporary government role in the space insurance industry.

Response. Limited temporary actions by governments should be envisioned only in paragraph B situations.

STATEMENT F. In light of your above comments, the preferred launch vehicle is: (Pick one of the following and specify "WHY").

1. A dedicated expendable launch vehicle (ELV)—only one payload e.g. A Delta or Atlas—Centaur rocket;

2. a multiple-payload ELV—capable of 2 or more payloads e.g., the Ariane rocket; or

3. A multiple-payload reusable vehicle such as the shuttle.

Response. Two parameters are important: The overall reliability of the mission (up to geostationary orbit); total cost of the operation.

With regard to the Shuttle system, the deployment and supplementary perigee stages practically offset the great reliability of the Shuttle itself. As a result, from the insurer's point of view, the reliability of ELVs, including Ariane, is virtually identifical to that of the overall Shuttle system, which explains why the insurance rates are currently very similar.

With regard to total operating costs, under current conditions of Shuttle operations, the real launch costs are higher due to the nature of manned space flight. It is therefore probable that for a long time to come and until demand requires an increase in launches, ELVs will be less expensive than the Shuttle. The double launch technique used by Ariane offers the advantage of further significant cost reductions.

Senator GORTON. Thank you, very much.

Mr. d'Allest, in your interesting statement, you point out that arianespace will provide an additional capacity to that available now. Is that additional capacity simply to provide this form of reflight insurance, which you described, or is it more capacity for initial flights, as well?

Mr. d'ALLEST. The issue we are facing is, as I have said, we have customers who are today unable to go ahead with a launch due to the lack of capacity. So the basic problem is to try to add the lacking capacity as we see today.

So what we offer to our customer is by a kind of mutual—of pooling of a series of ariane flights to offer him an additional capacity to meet his requirements. So it is not specifically designed to add further flights. It is requisite to be able to carry out particularly dual launch activities that we are carrying out with ariane.

Senator GORTON. I may have missed it; how much additional capacity are you talking about?

Mr. d'ALLEST. Today, it would depend upon the market conditions. Today, for a typical launch of ariane with two satellites on board, the available capacity is roughly half what is needed. And this is what we plan to offer, the other half. That means if we are reasoning on the ex-

isting capacity of $70 to $80 to $100 hundred million, if you are optimistic, the required capacity for a launch with two satellites, is on the order of $160 to $170 million dollars.

So we are preparing ourselves to offer the $70 or $80 million lacking.

Senator GORTON. Your statement includes the proposition that NASA's new reflight plan involves a heavy subsidy of the cost of reflight. Your reflight insurance premium, by your description, is somewhere between eleven and thirteen percent. Is this a subsidy in a market in which, presumably the minimum reflight insurance on the open market, costs fifteen percent?

Mr. d'ALLEST. Mr. Chairman, on this point, as it has been said by some other people testifying, the basic issue is that there has been an underestimate of the risk of such launches and commercial operations. Because, basically, what the past experience shows, over the last nearly 15 years, is that the average premium has been around 7 percent, and the loss would have been in balance with premiums of roughly 14 percent.

What we are going to propose is very near 14 percent, because it is paid 2 or 3 years before the launch.

So our approach is not to subsidize. We have not the capability for that. Our approach is simply for an engineering approach—we are not experts in insurance—but simply the fact that over a series of 15 flights of ariane, we are considering to face a maximum one failure—it is the experience of the expendables—and we are confident to meet this, and in case we are—and this is one-fifthteenth, basically 7 percent—and we will need this extra 4 or 5 percent more to insure in case of calamity and we have a second failure.

This is not a subsidy. It is a balance, a balance between reasonable assessment of the past experience in the expendable launch and the premium required to balance the predictable loss.

Senator GORTON. You are just providing it at cost, as far as you are concerned?

Mr. d'ALLEST. Yes.

Senator GORTON. In your statement, you criticize the current shuttle pricing policy because of, and I quote your statement, "freely acknowledged and considerable subsidies in the current shuttle pricing policy'.

Does your comment refer to the administration's new pricing policy of $74 million in 1982 dollars?

Mr. d'ALLEST. Yes, Mr. Chairman, and this issue is presently debated by the European member states for Western Europe and it will come back to the U. S. Government, because it includes subsidies, and it is really providing a distortion in the competition and puts in difficulties the development of commercial space transportation venture.

Senator GORTON. Mr. O'Brien, do you want to comment on that?

Mr. O'BRIEN. Mr. Chairman, I think that this whole issue of what is a subsidy and what is not is largely in the eyes of the beholder. Certainly, I think Mr. d'Allest has had a very consistent view of the shuttle price over a period of time, and obviously it has not changed here this morning.

I think that the history of how we have arrived at the current $74 million base price for a shuttle flight belies the fact that subsidy is involved at all. I think it is a full-cost recovery approach. As you know, it was the subject of great internal debate within the executive branch. Some of those people are here in this room who were involved in that great debate, and it was thoroughly shook out, but within the frame of reference set by the President, which was full-cost recovery.

We believe that what we have arrived at in the executive branch represents full-cost recover, not a subsidy.

Senator GORTON. I understand that NASA is experimenting with a new relaunch policy for failed payloads under which the replacement payload will be relaunched for about 50 percent of the customer's original launch cost.

While this is certainly an innovative approach that obviously attempts to restore some calm to the satellite insurance market, who pays for the 50 percent discount that the customer will receive? From a budgetary standpoint, what is that going to cost? Where is that cost going to be located?

Mr. O'BRIEN. First of all, it is not really a 50 percent discount. Let me just set the stage for understanding, I think, my response to your question.

Number one, we have had, as you probably are aware, a reflight policy in place for some time. That reflight policy essentially is that if the shuttle system is responsible for a failure with respect to a commercial payload—that is to say, we cannot deploy or for some reason the satellite is made inoperative because of a NASA fault—our reflight policy affords a reflight at no cost. Okay? That is sort of a damage concept. In other words, we caused the damage, therefore we are going to fly you again free, because it was our fault.

That policy is in existence and has been for some time. What we are experimenting with now is an alternative to that which would provide a reflight at marginal cost, which means no cost to the taxpayer. It is just a marginal cost of handling the event on a future shuttle launch, for any failure to the system from launch through deployment, through ninety days of initial on-orbit check-out or operations.

So we are covering a 90-day period, beginning with the launch. What we are saying is that as an alternative to a free reflight due to NASA fault, we will refly you at marginal cost, no cost to the taxpayer, no matter what happens, for 90 days.

Senator GORTON. Is that a better deal?

Mr. O'BRIEN. Well, it depends perhaps on what confidence you have in NASA, versus what confidence you have in your own payload checking out in orbit.

Senator GORTON. So far you haven't had to utilize this relaunch policy, have you?

Mr. O'BRIEN. No, sir.

Senator GORTON. Have you?

Mr. O'BRIEN. No, sir.

Senator GORTON. But had this policy been in effect over the course of the last 2 years, there would have been considerable liability, would there not?

Mr. O'BRIEN. No, not necessarily. There was perhaps one incident that would have been covered. The LEASAT-3, but that is recovering, as you know; getting well.

Senator GORTON. Both for you and Ms. Dorn, each of you has stated that under the present circumstances, any form of Government intervention to the direct insurance business would be inappropriate and premature.

Perhaps you would describe for me what circumstances would cause the Federal Government intervention to be necessary or appropriate—30 percent insurance premium, 35 percent insurance premium? At what level or under what circumstance might the Federal Government be involved?

Mr. O'BRIEN. Ladies before gentlemen.

Ms. DORN. Thank you. That is the first time.

Just kidding. I am sorry.

Mr. Chairman, I do think it would be, given the conditions of the market right now, unwise to speculate at what specific premium Government would consider intervening. Certainly in this time period in the market, we appear to have willing buyers and willing sellers who are eager to make this work. Since the majority of the insurance industry seems to feel that Government intervention is unwarranted, I feel that we should listen to those signals.

Certainly, it would also be foolhardy to say that at no time, in any situation, would the Government revisit its policy. That is why I think that Secretary Dole and Secretary Baldrige are concerned and monitoring the situation so that the Government does know the causes, the effects on the transportation industry, so that we can be ready to reassess the policy, if necessary.

We certainly don't see such a situation at this point in time.

Mr. O'BRIEN. I certainly agree. I would add one other thing, and that is that each additional step the Government takes to move into the insurance industry, takes away some piece of opportunity for the industry to recover.

In other words, you are removing a portion of the premium pool, those things which they can attach premiums to and hopefully get healthy again. So, I think we should move very cautiously when we consider getting the Government more involved in their business.

Senator GORTON. I am not surprised that you are unwilling to come up with specific percentage levels, even though there might be some level at which it would take place. But, let's approach the subject from a different perspective.

I understand that premiums now are approaching 20 percent and it is possible that they might rise to 30. What kind of impact are these premiums, or the threat of 30 percent premium rates, having on operations?

Mr. O'BRIEN. None, to my knowledge. We have not had anyone pull off a Space shuttle launch because of an insurance issue, and I am not aware of any potential.

Senator GORTON. Even any future threats?

Mr. O'BRIEN. No, not that I am aware of. Just let me add one thing. You know, I keep hearing different sorts of things. Some people are saying—hey, we will pay what we have to pay; we still need the insurance. That may be where you have a single payload, perhaps; not a string of satellites in a mission model. So they will pay. Thirty percent? We will pay.

On the other hand, where you have a large program coming along with a number of satellites involved, those folks are starting to say—well, maybe we won't pay, but we will add another satellite and that will be our insurance, instead of buying policies.

There is a lot of fluidity here in this situation, but I think an awful lot of thinking and innovation is going into it. There may be pooling coming up. We don't know. I think it is too early to tell, but I can say that, right now, we know of absolutely no operational impact that we have seen because of insurance.

Ms. DORN. With respect to the commercial expendable launch vehicle industry, Mr. Chairman, as you are aware, the timing situation works to a certain degree as an advantage. None of the commercial ELV industry has yet to have a customer to sign on the dotted line, and in contrast to the space shuttle and to arianespace, customers are not on-line to be launching in the near future. So, we look forward to a series of successful launches improving the situation so that the expendable launch vehicle industry can have the confidence that there will be the capacity available at a reasonable rate.

And certainly with respect to the capacity issue, expendable launch vehicles have a slight advantage because of their dedicated payload and not requiring as much insurance on a single launch.

Senator GORTON. Mr. d'Allest, does Mr. O'Brien's answer pretty much apply to arianespace, as well? Are your customers having difficulty in getting insurance, or are any of them reflecting on whether or not they want to go ahead because of insurance problems?

Mr. d'ALLEST. Mr. Chairman, we have surprisingly a very different experience. We have clearly three customers ready to go ahead who are stopped by this issue. It is not only the premium level, it is upstream from that. It is the capacity to manage the risk.

A private company investing $200 or $300 million in a space system cannot go ahead without limiting the risk. So, we see definitely today on lauches scheduled for next year or in 1987, a big issue today which clearly is not solved by the insurance market today, neither in a couple of months or in 6 months—and as I said, we are vitally concerned, because it would disrupt our launch operations.

This is why we have decided to take risk from the other side and to offer something to help.

Senator GORTON. Mr. O'Brien, one of the witnesses who will be on the next panel states in his testimony that NASA's new relaunch policy will seriously harm the space insurance market because NASA and arianespace will eliminate any competitive advantage. By matching of the commercial market, it will be deprived of the premium revenues, spread the risk it needs to return to a healthy position.

Now, in a sense that is almost a direct contradiction of what you have answered to my last question, about depriving the insurance business of premiums. Can you respond to that?

Mr. O'BRIEN. Yes, Mr. Chairman, it would appear to be a contradiction. I don't know whether it really is or not, but it doesn't seem to me that by our reflight alternative that we are talking about here, we are depriving anyone of the opportunity of still insuring their payload.

I think they are two different issues. The reflight does not in any way constitute an insurance policy with regard to damage to a payload. I think if I were a user, I would still insure my payload against loss. They are two different things. We are offering a launch at a certain rate, which has nothing to do with insurability of the property.

I think the premium might be different because we have defined the risk better, for relaunch. But I don't see where the need for insurance goes away. So the satellite would still be in the base for distributing premiums.

Ms. DORN. Mr. Chairman, if I could just comment briefly on that, from the perspective of the private sector ELV industry. They have raised some concerns about a policy which I have not seen in written form, and so I am not aware of the details. It seems the President's policy with respect to pricing very clearly indicated that a $74 million minimum would be established for a commercial payload.

But a policy which allows a discounted rate for a particular flight on the shuttle appears not to reconcile with the President's pricing policy. I must, of course, issue the caveat, that I have not seen it in its specific form. There may be something that I misunderstanding here.

Clearly, it is a concern of the private industry because the Government user, the user of the Government system has an added benefit, although slight, that the private sector vehicle operator would not be able to provide on a commercial basis.

Senator GORTON. For all of you: There certainly has been discussion about having the satellite manufacturers assume——

[Pause.)

Senator GORTON. I am now going to have to go to a mark-up committee for what I hope is not too extended a period of time. I only had two or three more questions for you all. Mr. Perkins will ask them, so they will be on the record. We may then have a few others in writing, as well.

At that point, we will be in recess until I come back to start with the next panel. This will allow you all to complete your testimony.

Thank you.

Mr. PERKINS. To continue, there has been some discussion about having satellite operators, or satellite manufacturers assume more of the risk associated with initial in-orbit testing and checking out of satellites, and also by the same token, having upper stage manufacturers assume some responsibility about that aspect of satellite deployment.

Could you comment on this idea as to whether it is an appropriate response to the current situation? Each of you, please.

Ms. DORN. Yes, Mr. Perkins. It would seem to me that so many members of the private sector community have offered that as a potential solution to the problem, it would be well worth exploring. In terms of the Government saying whether this is a good idea or not, I would say, whatever private sector approach works to solve the capacity problem and the premium rate should be attempted.

Mr. PERKINS. Mr. O'Brien.

Mr. O'BRIEN. I have no objection to manufacturers assuming more risk for their product, or the upper stage manufacturers, but I am not sure what that means. One thing it might mean is just shifting who pays the premium for the insurance, from the operator to the manufacturer. That would be one scenario.

Another scenario would be an assumption of risk by the manufacturer without insurance. Now, fine, they can assume any risk they want, and then whether they insure or don't insure is just a question of whether they want to pay the freight.

By one way of looking at it, is just an allocation of premiums from one citizen to another.

Mr. PERKINS. Mr. d'Allest.

Mr. d'ALLEST. Sir, as I said in my testimony, we welcome and support any initiative which would prevent a slow-down of the commercial space industry development. We consider that in the coming one or two years, there would be a slow-down due to this problem.

So, any initiative coming in, supplement—I insist on this word—to supplement the existing market, because the basic question is not so much the premium—though I question very much twenty-eight or thirty percent premium today—but the basic problem is first the capacity to manage the risk and to have this reasonably covered.

So we welcome and support any ideas, such as satellite pooling or manufacturers retaining part of the risk, by transfer, as something which can bring some relief, at least in the short term.

Mr. PERKINS. Mr. d'Allest, have in the past, or even now, the French Government, or arianespace or ESA provided any assistance to the satellite operators, or arianespace customers in trying to obtain launch or operational insurance?

Mr. d'ALLEST. When we started our operations in 1980, we had a problem. The problem was that we had no record of flights of ariane, and we had first to convince our customers that we would have a record similar to the U. S. expendables, or with the shuttle, plus perigee stages. We could convince them only by committing ourselves on the basis that, in case, when we come to the launch there will be insurance

quotation much higher for ariane than the other expendables or shuttle, to assure confidence in the ability of the rocket, we would accept, on a commercial basis, commercial risk in terms of a share of the premium difference between ariane and the other expendables.

This problem is now settled because we have shown and it has now been accepted by the insurance market, since we have now quotations for ariane which are similar to the others, so this problem no longer exists. But, yes, we have done such thinsg 2, 3, and 4 years ago.

Mr. PERKINS. Would you expect that under the present circumstances, or if there were another significant claim, that either of these entities, the French Government, arianespace, or ESA, would intervene and provide assistance?

Mr. d'ALLEST. We did not plan at all that European Governments intervene in supplying insurance or covering risk. It is clear—maybe it is not always well understood—it is very clear; it has been checked through the TCI complaint against arianespace—it has been established clearly that our running our operation, our production and our launch on a commercial basis, balancing of expenditures ourselves, and for the insurance we are now going to provide, or reflight guarantee against a premium, that our scheme is very clear.

We want to say to our customers, as we have always said, our reliability is around 94 percent. This means that we have to provision roughly one failure every 15 flights, and this is 7 percent, and on top of this, to protect ourselves against what we say in French, "serie noir," in the unlikely event of a second failure, such failure, to reinsure, and then come up with this 13 or 14 percent. So, it does not need specific measures.

We consider—as it has been shown, as I said, by the last 15 years—that the issue is to have the premium reasonably balanced with the loss. The basic fact, as has been tesified by other people, is that the premiums have been too low; that the loss, while it is normal since we are in the maturing process, but now there is sufficient experience to consider that with premiums in the range of 13, 14, maybe 15 percent, insurance market should be able to make a reasonable profit.

Mr. PERKINS. Ms. Dorn, according to your testimony, many insurers claim that the current round of insurance losses have resulted from faulty assessments of the risk associated with the launch and operations of communication satellites.

What is your understanding of the basis of their term "faulty assessments"?

Ms. DORN. Mr. Perkins, I would like to put that in context in the entire statement. No criticism of the insurance industry was intended here. Certainly, it is one of many elements that has caused a problem in the insurance market. Hardware failures and differing assumptions that space was more reliable than in fact it has proven to be in the last few years, were problems that resulted in the situation we face right now.

In addition, and this is certainly not exclusive to space insurance, but all insurers face the situation where low premiums were quoted in order to compete for business opportunities, so that investments could be

made at a high dollar rate, and when the inflation period was at its highest. So, certainly this is not a problem that is confined to space insurance.

We are confident that as we increase the number of launches over which the actuarial base can be spread, that some of those problems will be eliminated. Certainly, the more successful launches we have, the more reliability the insurance industry will be able to have in making an estimate as to actuarial losses.

Mr. PERKINS. Some of the testimonies from the later witnesses indicate that there may have been problems in the satellite manufacturing industry, problems of quality assurance. I wonder if you think that this is a problem, or a condition that has contributed significantly to the current situation—the three of you, please.

Ms. DORN. In our discussions with members of the insurance industry, most of them have said the amount of information available has been at least adequate, or if it was not adequate, they had the means by which to get the information they needed to assess the level of reliability.

The whole issue of standards—and imposing standards—Is one that the Department of Transportation has faced as we develop our regulations. And, I know that you, in the passage of the Commercial Space Launch Act recently, indicated a clear preference, with which we totally agree, that when it comes to reliability issues, it is most appropriate that reliability be measured or the standards be imposed by the private sector.

The appropriate role for Government in our view is to assure the safety. And as long as we can assure that the safety of the public is protected and our national security and foreign policy needs are met, then for the Government to impose any other kind of mission success or reliability standards, I don't think would be appropriate, I do not sense that that is the desire of the insurance community, nor in my personal view do I believe that that would resolve the problem.

Mr. O'BRIEN. I would serious doubt that there is a lack of quality control or reliability by satellite manufacturers because of any insurance base that may be there to insure failure, or a lack of it being there. I think that we are talking about very heavy investment. You are talking about a very competitive market, and I think that quality comes with the manufacturer and the product, and the good name of the company.

So I think there are motivations there quite apart from an insurance policy, that drive quality and reliability. So I would tend not to couple in my own thinking the availability or lack thereof of insurance with quality, in that sense.

Mr. d'ALLEST. I think that each time there is a failure, there has been a deficiency. It is never the fault of bad luck. So, the issue as to whether or not there has been a new trend in the last 2 years towards lower quality—I don't think it is the case.

We remember, in Europe, that in a single year, we have lost two Europea satellites by malfunction and after that, there has been more than thirty successful flights.

So, we know and as far as anything specific is concerned, we have a longstanding policy of responding. We have an inquiry board and we give a report to the customer and to the insurer, and I think this is the same by NASA or by space craft manufacturers.

The issue is to have a reasonable assessment of the risk incurred. And to my judgment, what has happened is that, due to the advent of the Shuttle and of Ariane and due to the acceleration of the telecommunication satellites in the last 3 years, there have been many more launches of commercial satellites than 4 or 5 or 6 years ago. There are more risks exposed with basically similar know-how. Maybe sometime there are new satellite or new technologies to be tested, but basically it is not quite surprising what has happened.

The failure of Atlas-Centaur, after the good series of success, the failure of Ariane after a series of success, the failure of the Titan last year, which was after maybe 40 or 50 successful launch, has to be predicted and has to be provisioned. So, the issue is not, to my mind, basically, the reliability of the Arianespace hardware. It is, to my mind, basically an underestimate of what reasonably should be expected as a failure rate of these systems.

Mr. PERKINS. In terms of the successful operation of upper stages, the point has been made that maybe an underwriters lab or some sort of technical evaluation process might be implemented to give insurers a greater degree of reliability or confidence in that hardward.

Is this something that should be given more serious consideration? Mr. O'Brien, and Ms. Dorn.

Mr. O'BRIEN. Well, I suspect if a UL type of operation were put in place for that purpose, that they, in turn, would become very heavy purchasers of insurance.

Mr. O'BRIEN. If anybody is going to get involved in assessing technically somebody else's product and they are going to get in bed legally with them, then there is going to have to be another form of insurance concocted for that type of activity.

Ms. DORN. I would stand by my previous statement. If the private sector believes that that is a problem, which we have not heard it expressed to date, whatever mechanism they established to reduce the level of risk, would be one that we favor.

Again, I think that that could be a very expensive kind of process for an unknown result, and certainly it would be one that is more appropriate to be conducted by the private industry than by the Government.

Mr. PERKINS. Mr. d'Allest, I understand that the Ariane 4 vehicle is scheduled for its first launch in 1986, in the middle or in the fall of 1986. When exactly will that first flight occur, and will this vehicle's technology possibly lead to greater confidence on the part of insurers so that lower insurance premium rates will be obtainable for that vehicle?

Mr. d'ALLEST. We, indeed, are going to launch the Ariane 4, the first unit, in the middle of next year, in August. We are aware that, I think for us, as for all spacecraft or launch manufacturers, that with the size and the cost of the new satellites, a loss is a heavy amount of money

and that certainly everybody has to work and is working to increase the reliability.

In ariane 4, we have made provisions to increase reliability. For instance, we have duplicated the inertial platform. We have done a number of other things.

This being said, for us, we are introducing this hardware within commercial operations and we want to avoid any disruption. This means that our approach has been basically to protect ourself from bright ideas and not to introduce new technologies, and our approach has been to stick within the basic technology as it is existing today.

So I don't expect significant change in the premium rating, going from ariane 3 to 4.

Mr. PERKINS. Mr. O'Brien and Ms. Dorn, some of our later witnesses in their testimonies have talked about certain space projects which may be uninsurable due to the nature of their technology, or due to the nature that they may be "first of a kind" endeavor.

Is there a role for the Government to assist, if in fact these projects are uninsurable, is there an appropriate for the Government here to provide insurance if there is a significant public good associated with this particular endeavor.

Ms. DORN. Certainly I would defer to Mr. O'Brien for the specifics of those kinds of Government assistance which we already provide, but it seems to me in many of the projects that we have outlined, the high-risk ones, the Government has determined that it is appropriate for Government assistance to ease that risk somewhat.

I think that beyond that, it may well be something that a private firm must incorporate, as part of the risk, in its own business plan. The advantage of the Government assistance which we now provide allows them to get over the hump as it were, and be able to utilize future availability of insurance.

It seems to me that, if necessary, we can reassess the situation when those different Government projects or projects which receive Government assistance are at the point where they would require insurance. At this point, they are not and they receive Government assistance for even the initiation of such projects.

Mr. O'BRIEN. I frankly don't know what is being referred to as an uninsurable technology. It seems to me, not being an insurance expert, but having been raised knowing something about insurance, since my father happened to be in the business for forty years, it seems to me that what I recall from childhood days is anything is insurable at a price.

I think a new technology, a difficulty technology—no matter what it is—look what we faced in the last 25 years, and things have been insured. So, I am not sure what kind of technologies are envisioned here that would not be insurable in the future.

It seems to me it is the typical assessment of the risk, assessment of capacity of insurance to apply to that risk and at what rate. I don't believe that I can tell you any technology that is in my head that will not be insurable. Perhaps you can develop that with whoever has made that statement.

Insofar as Government assistance is concerned, of course, you know NASA does monitor in a technical way the development of new upper stages now. So we are doing a fair amount to infuse our expertise into that process.

When it comes to satellite manufacturers, I guess first of all, we would have to be asked, but secondly, if we were, it is then a matter of resources, whether we could support a technical assessment activity. We have a capability to do it, but it is not available on a widespred basis. We would need help from the Congress there, resource-wise.

Mr. d'Allest, you have stated in your testimony that, as seen from the satellite operator's point of view, that shuttle missions and ELV missions have a comparable reliability and this question is for you and Mr. O'Brien: Is this perception reflected in comparable insurance rates, and if not, could you account for the difference in the insurance rates?

Mr. d'ALLEST. I think this question should be put to the insurance market, but what I can say is that the quotations which were made before these recent disasters, where now it is difficult to speak merely of the market—the market is now rethinking its policy. But, yes, 1 year ago, or 12 or 15 months ago, we were quoted similar percentages for a given satellite mission for ariane and shuttle, plus perigee stage.

Mr. PERKINS. Mr. O'Brien?

Mr. O'BRIEN. Well, I still maintain that Government intervention is not necessary or appropriate based on what we know at this point in time. And, I think anything that we can speculate on here today with regard to rates and capacity, would be purely speculation.

When the rates go up, I believe capacity will increase. So, you may solve one problem at the expense of another, and whether or not the industry will go for that at that price, I don't know. But I think what I am hearing is, as rates go up, additional capacity not in the game now would become available. So there are trade-offs to be made, obviously.

But I still believe it would be premature for the Federal Government to get involved.

Mr. PERKINS. That concludes the questions that the majority has.

Senator RIEGLE. I want to thank the panel for their testimony. As is often the case here in the Senate, we are meeting at this time in the Banking Committee, as well, on an important nomination which requires my involvement in another building on that issue.

But I want to thank you for your testimony. I may have questions to submit for the record.

Senator Gorton has indicated that he would like a brief recess, once we finish with this panel, before the next panel starts, so he has a chance to return.

Let me thank you, as a panel, and indicate that we will be in recess until Senator Gorton returns.

[Brief recess.]

Senator GORTON. We can reconvene this hearing. Mr. Hewins, Mr. Stockwell, Mr. Barrett, Mr. Cassidy and Mr. Simonoff.

Senator GORTON. I apologize for delaying all of you. each of you has submitted a written statement, which will be included in the record. I am afraid, in the interest of time, I am going to have to limit your opening comments to 5 minutes.

So if you can through you statement in that time, it would probably be more helpful to the Chairman if you would attempt to summarize your statements. Mr. Hewins.

STATEMENTS OF A. MICHAEL HEWINS, VICE PRSIDENT, JOHNSON & HIGGINS; BRIAN STOCKWELL, PRESIDENT, CORROON & BLACK INSPACE; JAMES W. BARRETT, PRESIDENT, INTERNATIONAL TECHNOLOGY UNDERWRITERS; DANIEL E. CASSIDY, VICE PRESIDENT AND DIRECTOR, MARSH & MCLENNAN AVIATION AND AEROSPACE SERVICES; AND JEROME SIMONOFF, VICE PRESIDENT, CITICORP INDUSTRIAL CREDIT, INC.

Mr. HEWINS. Thank you, Mr. Chairman. I begin with the assumption that the national goal of commercial development of space is a public good. If this is a valid assumption, which I take it to be, then it is in all our interests to ensure its ultimate success and my remarks are based on that premise.

While we are today examining the current problems of the space insurance industry, I think that we should bear in mind that any solutions sought must be done so with an eye to the future of space commercialization. Commercial space projects require substantial financial outlays. This is particularly the case with the space station, a project requiring a number of launches to provide materials and complete construction.

Insurance will play an important role in the operation of the space station and other future space projects, just as it has done in the development of new industries and their technologies in the past.

It is common knowledge that the space insurance industry is facing a crisis of confidence, both technically and financially. Since February 1984, losses totalling approximately six hundred-thirty three million dollars have occurred. This total does not take into consideration the possible resale value of the recovered satellites or the possible successful insertion of the repaired Syncome IV–3 spacecraft into its final orbit.

Such staggering losses have precipitated a reduction in the available insurance capacity—that amount underwriters are willing to risk on any one event—from an estimated high of $250 million to $300 million in 1982, to approximately eighty to one hundred million today.

The second range of figures is not certain as no launch program has been placed in the market since the ariane 5, 15 failures in September 1985.

Space insurance is not an inelastic commodity. I think that is obvious. Because of the losses, underwriters have increased launch insurance rates from a low in 1983, of 5 percent of the sum insured on launch, to current predictions of 30 percent. Rates on in-orbit operation have

have climbed from one percent of the sum insured per annum to four to five percent per annum.

All types of space insurance rates have risen regardless of loss ratios. The reason is straightforward. The same players underwrite portions of all the different types of policies so that losses all come out of the same small pool.

There is very little differentiation of buyers in this market because of the limited spread of risk—the small number of events—and now underwriters are attempting to recover their deficit at the expense of the buyers, regardless of their loss experience.

Besides constricting capacity, the recent losses have moved underwriters to restrict the period of time before which they will commit themselves to launch programs to ninety days before launch. Prior to February 1984, a buyer could obtain launch insurance for launches three years in the future.

As a result, satellites are still being launched today which have the benefit of insurance rates of 5 to 6 percent.

Such a time limitation has ramifications for the owner's financing. While financiers are willing to take the debt risk, they are not willing to take the risk of physical damage resulting in a business failure; that is not their business, it is the business of insurance.

Previously, saellite owners could buy insurance 3 years prior to launch when they had to begin making progress payments to the manufacturer of the satellite and construction began. While large, established companies may be able to absorb such costs until insurance is obtainable, new companies, run on entrepreneurial drive and the proverbial shoestring cannot.

It is debatable whether the survival of those with existing ability to do so will ensure the innovate and competitive commercialization of space. It may very well be this situation has implications beyond the satellite communications business.

At this juncture, the constricted space insurance market is creating a bottleneck to commercialization which may be artificial; that is, it may not be the market for a proposed space venture that determines its economic viability, but the inability to obtain financing to unavailability of prohibitively high cost of insurance.

The comment has been made that, if insurance considerations prevent a satellite project from going forward, it probably should not survive at any rate. This may have been a tenable view with 5 percent rates, but the predicted 30 percent rates may be prohibitive to some companies faced with $100 million project costs.

This must also be considered in the light of the fact that previous predictions for a booming communications satellite business have fallen short of expectations.

Insurance, in its simplest terms, is the losses of the few being shared by the man, and operates according to the law of large numbers. Space insurance does not fit this definition as the losses of the few have been shared also by the few. Space insurance does not enjoy the spread of risk of other lines of insurance. In fact, its spread is dangerously thin.

Any one event skews the experience, provoking significant swings in the rates.

It is an obvious axiom in this business that the impact of failures on rates far outweighs the effect of successes. There are not enough statistical events.

Even without another loss, the space insurance market will not see profit for at least 2 years. There are 6 payloads this year, 23 next year, and 15 the year after. Given the current projects of maximum available capacity of $100 million per launch, at a 30 percent rates, premium volume for the 3 years on launches that are uninsured to date, would be $900 million. That is only one-third more than the losses currently in the market. And no one would give odds on the probability of 3 loss-free years.

These projects are coupled with the fact that technology is changing continuously, taking the underwriters beyond their existing base of experience. Underwriters must consider whether modifications and innovations to existing satellite and rocket technology will enhance our reliability.

Where does this all lead? While I believe we should seek to maintain a free market approach, we must also be aware of a recognized public good that coud be thwarted, or at least be chilled in the foreseeble future.

The space industry is exploring alternatives, including higher retention levels, which may not help the small company, and industry pools for group risk-taking. The possibility of redistributing the risk contractually among the parties, owners, manufacturers, and launch vehicle agencies, is being discussed. NASA has proposed reflight guarantees with reduced prices, while arianespace is attempting to put together a risk pooling mechanism for its customers.

However, owners must still obtain financing and, ultimately, insurance.

I believe Congress should set up a task force made up of private industry and Government to investigate the options available to help the industry, as has been done before with other embryonic, new technology.

Thank you

[The statement follows:]

STATEMENT OF A. MICHAEL HEWINS, VICE PRESIDENT, SPACE SYSTEMS GROUP, JOHNSON & HIGGINS

My name is Michael Hewins. I am a Vice President of Johnson & Higgins and manager of its Space Systems Group. We are responsible for the arranging of insurance for space projects of clients of Johnson & Higgins.

I have been asked as a member of the space insurance industry to comment on the current state of the market, to examine its potential future impact on the commercialization of space and suggest some realistic answers.

I begin with the assumption that the national goal of commercial development of space is a public good. If this is a valid assumption, which I take it to be, then it is in all our interests to ensure its ultimate success. My remarks are based on this premise.

While we are today examining the current problems of the space insurance industry, I think we should bear in mind that any solutions sought must be done so with an eye to the future of space commercialization. Commercial space projects will require substantial financial outlays. This is particularly the case with the space station, a project requiring a number of launches to provide materials and complete construction. Insurance will play an important role in operation of the space station and other future space projects just as it has done in the development of new industries and their technologies in the past.

It is common knowledge that the space insurance industry is facing a crisis of confidence, both technically and financially. Since February, 1984, losses totaling approximately $633,000,000 have occurred. This total does not take into consideration the possible resale value of the recovered satellites or the possible successful insertion of the repaired Syncom IV-3 spacecraft into its final orbit.

Such staggering losses have precipitated a reduction in the available insurance capacity—that amount underwriters are willing to risk on any one event—from an estimated high of $250-300,000,000 in 1982 to approximately $80-100,000,000 today. The second range of figures is not certain as no launch program has been placed in the market since the Ariane V15 failure in September, 1985.

Space insurance is not an inelastic commodity. Because of the losses, underwriters have increased launch insurance rates from a low, in 1983, of 5% of the sum insured on launch to current predictions of 30%. Rates on in-orbit operation have climbed from 1% of the sum insured per annum to 4-5% per annum.

All types of space insurance rates have risen regardless of loss ratios. The reason is straightforward. The same players underwrite portions of all the different types of policies so that losses all come out of the same small pool. There is very little differentiation of buyers in this market because of the limited spread of risk—the small number of events—and now underwriters are attempting to recover from their deficit at the expense of buyers, regardless of the buyers' loss experience.

Besides constricting capacity, the recent losses have moved underwriters to restrict the period of time before which they will commit themselves to launch programs to 90 days before launch. Prior to February, 1984, a buyer could obtain launch insurance for launches three years in the future. As a result, satellites are still being launched today which have the benefit of insurance rates of 5-6%.

Such a time limitation has ramifications for the owner's financing. While financiers are willing to take the debt risk—the possibility of business failure from market forces—they are not willing to take the risk of physical damage resulting in a business failure; that is not their business, it is the business of insurance. Previously, satellite owners could buy insurance three years prior to launch when they had to begin making progress payments to the manufacturer of the satellite and construction began. While large, established companies may be able to absorb such costs until insurance is obtainable, new companies, run on entrepreneurial drive and the proverbial shoestring, cannot. It is debatable whether the survival of those with the existing ability to do so will ensure the innovative and competitive commercialization of space. It may very well be this situation has implications beyond the satellite communications business.

At this juncture, the constricted space insurance market (low capacity and 90 days commitment limitations) is creating a bottleneck to commercialization which may be artificial; that is, it may not be the market for a proposed space venture that determines its economic viability but the inability to obtain financing due to unavailability or prohibitively high cost of insurance.

The comment has been made that, if insurance considerations prevents a satellite project from going forward, it probably should not survive at any rate. This may have been a tenable view with 5% rates; but the predicted 30% rates may be prohibitive to some companies faced with a $100,000,000 project cost. This must also be

considered in light of the fact that previous predictions for a booming communications satellite business have fallen short of expectations.

Insurance, in its simplest terms, is the losses of the few being shared by the many, and operates according to the law of large numbers. Space insurance does not fit this definition as the losses of the few have been shared by the few also. Space insurance does not enjoy the spread of risk of other lines of insurance. In fact, its spread is dangerously thin. Any one event skews the experience, provoking significant swings in the rates. It is an obvious axiom in this business that the impact of failures on rates far outweighs the effect of successes. There are not enough statistical events, as yet, to work with reliably.

Even without another loss, the space insurance market will not see profit for at least the next two years. There are 6 payloads on 3 launches left this year. In 1986, there are 23 payloads on 16 launches, and in 1987 there are only 15 payloads on 12 launches. Given the current projections of maximum available capacity of $100,000,000 per launch at a 30% rate, premium volume for the three years—on launches uninsured to date—would be $900,000,000—only one-third more than the losses currently in the market. And no one would give odds on the probability of three loss-free years.

These projections are coupled with the fact that technology is changing continuously, taking the underwriters beyond their existing base of experience. Underwriters must consider whether modifications and innovations to existing satellite and rocket technology will enhance reliability.

Where does all this lead? While I believe we should seek to maintain a free market approach, we must also be aware of a recognized public good that could be thwarted, or at least be chilled, in the foreseeable future.

The entire insurance industry is going through very hard times. All lines are affected by unprecedented rate hikes and reduced limits. Previous crises have seen responses, for example, the formation of insurance companies by industry to respond to a lack of capacity or pricing problems for certain lines of insurance. Other responses have been the provision for higher retention levels and the purchase of reduced limits. It remains to be seen whether the participants in space insurance will seek implement new methods of doing business.

The space insurance marketplace is fragile. More losses will further diminish capacity, perhaps eliminating it—and no one expects the future to be loss—free. The industry is concerned about the possibility of a space insurance market failure. Lining this up opposite the assumption of space commercialization as a public good leads me to the conclusion that all options should be explored.

The space industry is exploring alternatives, including higher retention levels (which may not help the small company), and industry pools for group risk taking. The possibility of redistributing the risk contractually among the parties—owners, manufacturers and launch vehicle agencies—is being discussed. NASA has proposed reflight guarantees with reduced prices while Arianespace is attempting to put together a risk pooling mechanism for its customers. However, owners must still obtain financing and, ultimately, insurance. The costs are currently high, with no relief in sight.

I believe Congress should set up a task force made up of private industry and government to investigate the options available to help this industry as has been done before with other embryonic, new technology industries. Consideration may be given to the establishment of an Export-Import Bank type entity to guarantee financing until the necesary insurance can be purchased. This may also be accomplished by direct bridge loans for companies which cannot get initial financing. The government could investigate indemnifying private insurers above a prescribed limit of losses per year—as is done for third party liability—or perhaps, provide tax benefits for underwriters in space insurance.

The space insurance industry has suffered extraordinary losses, but in spite of this, underwriters remain committed to this class of business. However, available capacity has reached a threshold whereby further diminution may provide untenable for any major space project. Insurance rates have attained a level where retention of the risk is a real alternative for those companies able to afford it. It is hoped that market forces will rectify past adversities. However, in the absence of favorable future loss experience, other alternatives must be sought. With the development of space as a national goal, it is imperative we explore all the avenues available that will help to facilitate the industrialization space.

Mr. STOCKWELL. Thank you, Mr. Chairman. It is an honor to be here. I certainly hope I can stay within the 5 minutes. I have summarized my testimony on a number of particular, distinct points.

The first is that the space industry, as everybody has said, is indeed in a very poor state as a result of loss history that really is beyond belief.

Now the underwriters have their own perceptions, and perhaps with some justification, that losses have ocurred unreasonably; that claims have been made, and indeed, paid, that have included an undue proportion of profit, perhaps not always representing reality; that the insurance industry has been used as prop, as a substitute for true due diligence.

As I say, these are perceptions, but they are important perceptions. They may or may not be correct.

This perception results in an unwillingness of underwriters to support the industry, has driven rates sky-high and has drastically reduced available capacity. If the recent very high incidence of losses can be reduced in the future, then capacity may return to the market, but it will be long time before rates reduce greatly.

The current burning rate, that is the rate at which launch risks would had to have been written in order for the underwriters to have broken even, is not far short of 20 percent. We have heard 14—maybe it is 14, maybe it is 20, but it is very high.

There is little doubt that current conventional capacity will be a constraint to space commercialization, even given reasonable growth in capacity over the coming years.

There is similarly little doubt that launch vehicle and spacecraft vendors are either going to have to be more lucky in the future, in comparison with recent history, or be more careful, or both, if any capacity in any market is to remain in being.

That being said, major capacity problems will still remain, even in the best circumstances, and particular measures will have to be taken if insurance is not to put a long-term straight jacket on the larger and more risky ventures.

Insurance was already proving a problem area, and has been over the past years, for new ventures. Even when rates were lower and the money was not a problem, the ability to get a long-term commitment of coverage was a problem, with the lenders refusing to support funding when the guarantee of the availabilty of launch insurance when it was needed, was not at hand.

How could such long-term commitments be made by an industry with annual treaty renewals? It seems to the speaker that many parties have to contribute to the resolution of the present and on-going problem. One, launch service suppliers have to stand behind their product by not only providing more reliable product, but by providing in addition at least a partial guarantee of relaunch at zero or marginal cost.

You see the signs of this in the arianespace proposal, for a guaranteed relaunch, by inclusion within the launch service price of a reasonable premium, and in the NASA scheme for relauch on shuttle at marginal cost.

Another point. Upper stage propulsion system suppliers have to provide a more reliable product and to accept major penalty for their failure of that product, which has not always been at all the case.

Third point, spacecraft suppliers have to accept that a higher than current proportion of the price of the hardware is put at risk, their increased incentive fee, or warranty pay-back levels.

And system owners have to accept a part of the risk for their own account, either by accepting an element of co-insurance, where they share the loss, by accepting deducubles, by capping insured values at reasonable levels.

If these various measures are taken, and indeed it might be argued they should have been taken anyway in order to place at least part of the risk where it belongs, then the demand on the insurance industry will be reduced, provided that the various parties do not immediatey rush out to insure their so-called retained risk.

On other point, so far as the Government acting as insurer of last resort is concerned, the mechanics would be difficult, albeit, not impossible. It would not be easy to determine the highest rate in the market, so as to fix the Government rates at a level above this, and anyway, this rate could in the worst case turn out to be so high as to be prohibitive, thereby not even solving the lender's problems one can insure anything at a hundred percent rate.

Finally, it may be that there are ventures so expensive, so risky and so long term and yet so beneficial in the long-term, that despite the difficulties, the Government should intervene. Straightforward commercial telecommunications ventures hardly come under that heading.

Thank you, Mr. Chairman.

[The statement follows:]

STATEMENT OF BRIAN STOCKWELL, PRESIDENT, CORROON & BLACK INSPACE

INSURANCE CAPACITY, AND THE IMPACT ON COMMERCIAL SPACE ACTIVITIES

(1) Current and future status

The current situation is that the insurance industry is devastated by a series of losses the incidence of which is perceived as being quite unreasonable, and far beyond reasonable expectations.

The perception of underwriters may be summarized as follows, insofar as the events of 1984 and 1985 alone are concerned:

WESTAR 6 and PALAPA B2: total losses, both due to problems with the perigee stage rocket motor nozzle designed for maximum performance.

ANIK D2: a partial loss due to unexpected onboard attitude control problems with a "well-proven" spacecraft.

ARABSAT 1: notified as a potential total loss due to gyro problems even though it continues to function properly and seemingly within specification!

LEASAT 3: failure to activate, due to a failure in the switching chain, or perhaps to a build-up of mechanical tolerances.

LEASAT 4: dead in orbit after a few hours operation, apparently due to a failure in the antenna feed arrangement.

LEASAT 2: reported as a partial failure in-orbit, and not responding to receiver switching commands, a double failure.

ECS 3 and Spacenet 3: lost due to failure of the Ariane third stage (again).

There is no doubt whatever that underwriters have lost very heavily on space insurance business, and indeed since early 1984 alone the insurers have lost some 350 million dollars net. And the situation is perceived as worsening, not improving, and the space industry is viewed as immature and in some measure not reasonably insurable. Studying the list of failures above, one can sympathize, although at the same time underwriters can perhaps be reasonably accused of harboring undue false hopes—at least until February 1984.

Notwithstanding the currently very negative attitude that is being taken by underwriters, there is no doubt that an insurance market for space risks remains. It is diminished in capacity, to perhaps less than 100 million dollars per single launch risk (which may include several spacecraft), and rates are very high, on the order of 25% for launch and 5% per annum for life. Even then, with a "burning rate" for Ariane of 20% for example, underwriters will not get rich quickly (or recover past losses very easily). Also, Shuttle may be a marvellous machine, but he associated perigee stages and spacecraft may perhaps not be entirely so.

If the industry can get its act together, and suffer only ordinary rather than extraordinary losses, then matters will improve with time. New underwriters will come into the business, attracted by the rates now seen, and "old" underwriters may progressively have more success with the reinstatement of their re-insurance treaties. By the way, the worst is yet to come, since the result of the 1985 year-end treaty renewals will finally reflect the recent spate of disasters, and demonstrate the real loss of capacity.

In the longer term and given normal results it is not unreasonable to hope that capacity will become available so as to once again provide 250 million dollars of coverage per launch risk, at a reasonable and affordable rate of around perhaps 15%. Whether the earlier spread of rates between Shuttle and Ariane (now small indeed) will reappear, will of course depend upon the developing histories of these vehicles and of their associated upper stages.

(2) Insurance demand and commercial activities

There seems little doubt that conventional space insurance as it stands will be inadequate in the face of the demands of large-scale space commercialization. The parallel with oil rig insurance has often been used to support the thesis that capacity will develop so as to match demand, as has the parallel with the history of wide-body jet insurance been used to support the theory that rates will decrease with time and experience. In fact the contrary has proven true from the aspects of both capacity and of rate, simply because of the terrible loss record that has been experienced, and which has demolished all truisms.

If space commercialization is not to be constrained by the availability of insurance, unconventional measures will be necessary.

(3) Provision of adequate capacity

Even with the insurance market conditions as they are, and are projected to be even in the mid- to long-term, all is not lost. What is emerging is a jigsaw puzzle of coverages, of guarantees or warranties, and of risk retention, that can provide ade-

quate protection to users against unreasonable risk. Too much profit has been made by hardware vendors and even by users, and at the direct or indirect expense of the insurance industry, for the past situations to prevail.

It is not reasonable, after twenty years or more of quasi-commercial activity, that spacecraft or perhaps even more propulsion system vendors should wash their hands of the consequences of failure of their hardware not due to external and uncontrolled circumstances. Even contractual incentive schemes where 20% or 30% of the price of the product is put at risk in the event of non-performance appear inadequate, and it might even be argued that space hardware should only be paid for if and when that hardware is seen to work properly. Of course, in the 60s or even 70s it would have been unreasonable to expect the manufacturers of spacecraft and of perigee and of apogee motors to accept such an arrangement, but it is perhaps no longer so given the large current production of the mainstream vendors, even if it obliges these vendors to operate more conservatively in the future. That last 20 pounds pared off the hardware is not worth it, to anybody, if it unduly hazards the mission . . . and if the client thinks it is worth it, then underwriters would argue that the client, not they, should bear the risk.

Furthermore, it is not unreasonable for the Launch Service vendors to accept a measure of risk retention, at least in terms of the provision of a re-launch at zero or marginal cost in the event of failure of the launch system certainly, and perhaps even of the payload—and at a cost of the launch fee if necessary. NASA is of course offering a marginal cost relaunch in the event of failure from any cause, even up to 90 days of in-orbit operation and without cost, while Arianespace at least until recently was offering a relaunch at no extra cost, though the payload remains at risk, via an 11% fee added to the launch price.

Of course, if the manufacturer or supplier of the spacecraft, the propulsion system or subsystem, or the launch service immediately turns around and insures the consequent risk exposure nothing is really gained, since underwriters would still have all the risk and the onus for quality would be removed from the supplier. Not that one would for a moment suggest that vendors or system owners do (much) less than their best, but the real retention of the risk would certainly concentrate attention wonderfully.

With some or all of these measures in place genuinely insurable interests would remain: the spacecraft or payload value during the launch phase even given a free or built-in relaunch, and any proportion of value not accepted as a retained risk by vendors. Nevertheless, the demand on the insurance industry would be greatly reduced, and one might argue that the risk would in some measure reside where it belongs (finally).

Another matter is that of insured values. There has been a tendency in the past for system owners to insure not only for "property" values, that is to say for the replacement value of the spacecraft and of the launch service, but also for "extra expenses," lost revenue, and lost profit. There is in principle nothing wrong with this, but of course underwriters are entitled to question the reality of some of the profit estimates used in arriving at gross values. The idea should not be to make an (undue) profit from a loss. Thus values should and will have to be set within reasonable bounds, and system owners will in addition have to be prepared to absorb for their own account at least a fraction any loss—if for no other reason than because underwriters view such a retention (rightly or wrongly) as some sort of assurance of true due diligence.

(4) The role of government

There are several precedents for the Federal Government acting as insurer of last resort: for third-party liability beyond 560 million dollars for nuclear power generation risks, for inner-city property coverage, and for others. However, these precedents are inexact where property coverage is concerned (although completely applicable for third party risks), and a parallel between the shop owner in a downtown high-risk area providing an essential service and the owner of a satellite system aiming at making an interesting profit is a little difficult.

Further, one really wonders if the Government and the taxpayer have any role in supporting the insurance of purely commercial and voluntary exercises. It seems to the writer in fact that the risk should reside with the organization or organizations standing to gain. Why should the taxpayer protect a manufacturer or an entrepreneur from his own follies, should such they be?

Of course, there may be lines of endeavor where such support could be justified. The Space Station and its attendant commercial facilities may be just such a one. The investment required is huge, the long-term payoff potentially enormous, but the short-term risk perhaps unsupportable. Perhaps there the Government has a role as

insurer of last resort, in order that lenders may be protected and funding may be made available for these major long-term ventures.

Mr. BARRETT. Good morning, Mr. Chairman. Thank you for interest in the current space insurance issues, and for inviting me to address you this morning.

As part of my testimony today, I am submitting a background paper that discusses the current situation in the space insurance market.

It also explains in some detail what actions INTEC is taking to correct the situation.

In my oral testimony I would like to stress that what we face, as a result of the loss of seven communications satellites in the past twenty-one months, is not simply a space insurance problem. Because of these losses totaling more than $600 million, the amount of capacity available per risk has decreased dramatically from $260 million in 1983, to less than $100 million in 1986.

This situation is a problem, not just for the space insurance market, but for the space industry as a whole, because it reflects an unacceptable decline in the reliability of space hardware. Insurance has, and should continue to play, an important role in the commercialization of space, but it cannot compensate for unacceptable levels of reliability.

I believe that if space manufacturers and launch agencies improve reliability, the insurance market will be there to facilitate future commercialization of space.

In the past, manufacturers and launching agencies have transferred all of the risk of space projects to their customers through the procurement process. The customers have, in turn, transferred the risk to the insurance industry with obviously disastrous results. This practice cannot continue.

I believe that manufacturers and launch organizations must retain some of the risk of space insurance if space insurance is to continue to be available to support space ventures.

In order to give manufacturers and launching agencies a direct stake in improving reliability, INTEC has begun to require them to assume more of the risk in the launch and initial operations of a satellite. INTEC strongly believes that the spacecraft manufacturers should deliver the satellite on orbit to its custmer and not on the ground.

Because of the recent losses, there is no way to avoid higher rates for most types of space insurance. This is due to the simple fact that the cost of the risk in space has proven to be much higher than almost anyone expected.

Certainly it is much higher than the insurance industry projected. The cumulative deficit for the space insurance market since its beginning in 1968 is more than $500 million. The insurance market has no obligation to provide coverage at premium rates which do not reflect the industry experience. Nor should the market absorb all of the risk of financing a space project for the protection of commercial banks.

I must point out that not all space projects will be insurable, even at high premium rates. Development satellites and other highly advanced technology will have to be proven before commercial insurance is available. This is no different from the way insurance has developed for many other new technologies. The insurance industry should be available to facilitate, not subsidize, space commercialization.

INTEC believes that the changes we have instituted, plus the necessarily higher premiums because of the higher risks, will bring about increased reliability and a return to profitability. This should attract more capacity for future commercial space activities.

In addition, INTEC hopes to attract new companies to the space insurance business. One way is through "American Space Underwriters." This concept involves reaching out to many smaller insurance companies across the United States and encouraging their underwriting support of an insurance pool that would be dedicated to insuring space shuttle launches and cargoes.

I feel very strongly that the American insurance industry can and will do much more to support the Space Shuttle Program if we can demonstrate the opportunity to make an underwriting profit.

It is no secret that in the short run we will have reduced capacity, as I have described. We are already hearing talk of self-insurance, if sufficient insurance is not available. But self-insurance is not the answer.

So-called self-insurance exposes space enterprises to a restricted spread of risk and higher costs. One self-insured loss could spell serious financial consequences for a manufacturer or launching agency. Space insurance serves to spread the risk far wider than any limited self-insurance pool, without discriminating between thinly and highly capitalized space enterprises.

Given the magnitude of recent losses, the current decrease in the availability of insurance is simply a reflection of the functioning of the market. The current market reaction is typical of the cyclic pattern evident in all forms of insurance. As profits increase, capacity will increase.

In my view, there is no role for Government to play in this commercial market. Intervention can only disturb normal market processes. If the Government gets involved in space insurance, it will usurp commercial opportunities, erode the premium base, reduce the spread of risk and, in general, make it impossible for the space insurance market to go forward, let alone recover.

The best example of how Government intervention can disrupt market functioning is the competition between NASA and arianespace. In the past, NASA has offered its customers a free relaunch if the customer's satellite is not deployed because of a NASA-caused problem. We have heard that NASA intends to expand this offer to give its customers a re-launch at a substantially reduced price, if for any reason the customer's satellite fails within a given period after deployment.

We assume this proposed policy is intended to compete with arianespace's reported offer to its customers to provide guaranteed launch insurance for a price that is well below the market rate.

There will be one sure loser in this situation—the space insurance market. NASA and arianespace will eliminate any competitive advantage by matching each other, and the commercial insurance market will be deprived of the premium revenues and spread of risk it needs to return to a healthy position.

As a taxpayer, I am not enthusiastic about the idea of subsidizing a purely commercial venture, regardless of fault. In my view, Government intervention will not improve the situation, but it can make it impossible for the insurance market to recover.

This concludes my remarks, Mr. Chairman. Thank you.

[The statement follows:]

Background Paper on the Realities of Space Insurance

Everyone doing business in space must face reality. The unprecedented failure of seven communications satellites to be successfully placed on orbit during the past 21 months has dealt the beleaguered property and casualty insurance business a significant blow.

Technological developments and contractual arrangements in the space industry have produced unexpectedly high levels of risk and an improper allocation of risk. In addition, current satellite financing practices have sometimes produced an overstatement of satellite values and extraordinary and unrealistic demands for risk capital.

Quite, simply, the "cost of risk" of doing business in space has been grossly underestimated. The "cost of risk" in the space insurance industry is the sum of all the loss costs from space failures divided by the aggregate value of all commercial space ventures. Fundamental changes need to be introduced to restore balance and faith in the commercialization of space.

Recent space insurance results illustrates this point. The space insurance market has suffered more than $600 million in losses since February, 1984, and a cumulative deficit of more than $500 million since the market began in 1968. These losses are expected to force more than $150 million of insurance capacity to withdraw by the end of 1985.

Recent results also show that launch failure rates have doubled and appear to be increasing rather decreasing as the space insurance industry had hoped. No single cause accounts for these results. Most manufacturers and launching agencies have experienced multiple failures. Insurance underwriters look at satellite launches in separate sectors, i.e., launch vehicle performance, Space Shuttle upper stage performance, apogee motor performance and initial operations. With the exception of the Space Shuttle, no one of these areas has escaped serious loss.

Furthermore, recent claim settlements have identified certain inflexibilities of insurance coverages for some space projects. The space industry and underwriters failed to anticipate the repair of recovery of damaged satellites in low earth orbit. All of these disappointing results have led INTEC to advocate the reallocation of the risks of commercial space activities.

The space insurance business in a mere 20 years old. The bulk of experience has been gained in the past five years with the advent of the Space Shuttle, Ariane and the rapid increase of communications demand throughout the world. By comparison, the aviation insurance market is 80 years old and marine insurance more than 300 years in practice. Professional space insurance underwriters are only now learning the realities of space underwriting. Adjustments must be made in the following areas if the market is to survive and grow to meet the needs of space industrialization.

Many problems have been manifested in the space technology arena. Performance requirements are pushing the limits of current technology, removing safety margins and adversely affecting reliability. This was vividly demonstrated in the earlier use of carbon-carbon nozzle exit cones in some payload assist modules to save satellite weight. Unfortunately, this technology did not function as planned and resulted in two satellites drifting in low earth orbit until they were recovered. Reliability also suffers when features, which were not originally planned, are added during production, or when new features are inadequately tested.

Reliability is also called into question as the satellite population in orbit grows older and generic problems persist. Questions of reliability also arise when satellite lifetimes are overestimates. In addition, launchers now in use are relatively new and largely unproven.

Contractual and financial practices have also exacerbated this situation. Procurement contracts have traditionally placed most, if not all, of the risks on owners, not manufacturers. Manufacturers have not had sufficient financial incentives to improve reliability. Sale/leaseback arrangements and optimistic revenue forecasts have produced improper insurance to value. In addition, residual and salvage values have been underestimated, and the cost of businss rish has inappropriately been included in valuations for insurance purposes. All of these factors have contributed to an improper allocation of risk and premium rates which have been too low.

Clearly, the risks of establishing a satellite network have been underestimated and improperly allocated. What will happen if these problems are not addressed properly and soon? The continuation of past risk allocation will produce even worse results, but increased insurance rates alone will not motivate manufacturers to increase the reliability of space hardware. Manufacturers retaining more of the risk will be a strong motivator to increase reliability.

As INTEC has pointed out, government participation in insurance could be an impediment to the insurance market by undermining the premium base required to pay major space losses and adding levels of complexity and cost which would distort the functioning of the space insurance market. Government, in this case, should allow the marketplace to work freely to right itself.

Neither is self insurance a complete answer. So-called self insurance exposes space enterprises to a restricted spread of risk and higher cost. Space insurance serves to spread the risk far wider than any limited self insurance pool without discrimination between thinly and highly capitalized commercial space enterprises. All of these above approaches simply delay the necessary restructuring of the space insurance industry. Without this restructuring, we will likely see a sense of defeatism leading to withdrawal of entrepreneurial activities and a serious decline in the commercial attractiveness of space.

Recovery is possible. INTEC believes that several steps are necessary and has begun to implement the following changes in the way we do business. INTEC will provide insurance for those parties who can control losses and who are most directly affected by losses. This action will require changes in contracts between the manufacturer and owner; the manufacturer, owner and launch agency; and the insured and insurer. INTEC is also improving the depth and manner of information sharing among manufacturers, users and insurers. In addition, INTEC is encouraging increased reliability through improved internal loss control engineering and more careful selection of coverage offerings and pricing. These changes in structuring INTEC insurance coverages will more properly meet the needs of satellite owners, manufacturers and launching agencies and are capable of generating an underwriting profit. We have begun implementing these needed changes in the belief they will lead to a viable space insurance industry.

INTEC writes two basic types of space insurance—launch insurance and in-orbit insurance. Rates for launch insurance have increased. We will withhold coverage from the satellite owner during the initial operations phase of the launch. We believe that this risk is more properly allocated to the manufacturer. We will offer insurance coverages for performance of the Space Shuttle and expendable launch vehicles, and provide coverage for some upper stages. We will work with launching agencies to share the launch portion of the risk. In addition, INTEC will expand coverage to include insurance for salvage, repair, recovery and jettison of satellites on Shuttle missions.

For in-orbit insurance, INTEC will increase rates consistent with a satellite's age and risk exposures. There will be increased use of deductibles and coinsurance. We will attach this insurance only after successful in-orbit performance has been demonstrated. INTEC will require regular technical reviews to identify current anomalies and generic problems and can be expected to exclude existing anomalies. For on orbit coverages INTEC will use an indemnity approach and restrict coverage for extraordinary revenues and extra expense consistent with traditional rules of insurance to value. INTEC will also require a satellite system sparing plan and a clear demonstration of inherent redundancies and an operational contingency plan.

In summary, the reliability of space hardware has declined during recent months and is now significantly below reasonable expectations. Reliability could be improved if spacecraft manufacturers bore their share of the risk. This disappointing level of reliability has been evidenced by disastrous financial results for the space insurance market. No government intervention is required. By letting the market work freely and restructuring the industry, the current insurance problems can be corrected and insurers can remain the catalyst for doing business in space.

Mr. CASSIDY. My name is Daniel E. Cassidy. I am vice president of Marsh and McLennan, Incorporated.

The situation we are in today is a result of complex factors. Although there are no easy answers to the problem, we must seek solutions which enhance our ability to conduct commerce in space in a manner which permits the existence of a viable space insurance industry.

The recent space failures are coupled with the acceleration in space insurance values, and to some extent with the fact that space insurance underwriters have been charging premium rates below the historical failure rates. Clearly, if higher premium rates were charged, there would be less underwriting deficit today.

The nature of the insurance market, however, has always been cyclic. If history repeats itself, past losses will be written off, the insurance markets will respond to periods of good fortune, attract capacity and underwrite at premium rates which reflect current conditions and competitive forces.

For this to happen in the space insurance industry, however, it is necessary to show that risks in space can be managed in a commercial sense which implies limitations on the magnitude of exposure as well as the frequency of failure.

I believe that this can be done and that actions by both Government and private industry will contribute to achieving this objective.

During this period of recovery, more demanding underwriting requirements will be imposed with additional emphasis on parameters affecting exposure to failures and potential magnitude of casualty losses. I believe manufacturers and systems operators are keenly aware of their responsibility and will be making every effort to improve their product where it is reasonable to do so.

On the other hand, it may be that the nature of space systems are such that failures are sufficiently random and inevitable, and that risks should be spread over more events to minimize the consequences of failures. It has always been the concern of space insurers that insufficient actuarials existed to accurately assess loss potential. There just were not enough launches and satellites.

Recent trends, however, have been to further reduce the number of launches by putting more transponders on a single communications satellite and launching two or three satellites per launch vehicle.

In the near term, satellite manufacturers and operators are confronted with existing space insurance market conditions. The higher premium rates offer some prospect for either attracting new commercial insurance capacity or encouraging arrangements for mutually sharing risks through financial pooling.

Since we believe the situation is temporary, the Government should not intervene into the marketplace or take any action which may chill the prospects for insurance market recovery. Such actions may leave little hope for a viable commercial market in the future, create an imbalance in the allocation of risks and establish a reliance upon insurance not driven by commercial market conditions but the availability of Federal appropriations.

It is worth noting that if a Government pool had provided the insurance for all satellites launched on U.S. launch systems in 1984 and 1985, the appropriations necessary to pay claims above premiums collected would likely have exceeded $350 million, further adding to the Federal budget deficit.

I suggest that now may be an appropriate time to review the various Government policies affecting the commercial uses of space.

Although the actual implementation of Government policies can be quite complex, involving domestic and international interactions, it may be possible to rebalance interests to better accommodate the needs of private enterprise. From the viewpoint of having adequate insurance available at reasonable cost, this could manifest in less costly commercial space projects, and less accumulation of values exposed to any one space risk.

In this respect the FCC may wish, for example, to reasses policies on full spectral utilization or other requirements which may be forcing licensees to larger satellites.

NASA may also be able to reassess its procedures for shuttle manifesting in order to further reduce the number of insured satellites launched at any one time. Space station architecture should also be carefully scrutinized to minimize conditions which could force the accumulation of unreasonable large commercial values. In more general areas, NASA might also be encouraged to expand its various space technology programs and direct activities toward the specific needs of commercial satellites.

In addition, the Department of Transportation should be further encouraged to establish regulations and facilitate an operational environment conducive to private investment in commercial single launch systems.

In conclusion, Mr. Chairman, for commerce to expand in space, commercial conditions must exist with private investment exposed to minimum intervention and competition from Government. Viable insurance coverages are necessary ingredients in the equation for commercial space. I believe that the space insurance market will respond to the need, although the industry must see opportunities to achieve profitable results in the future.

The role of Government in space commercialization should not be that of insurer, but to foster an environment which accommodates the needs of private enterprise.

[The statement follows:]

STATEMENT OF DANIEL E. CASSIDY, VICE PRESIDENT, MARSH & MCLENNAN AVIATION AND AEROSPACE

Mr. Chairman and Members of the Subcommittee, my name is Daniel E. Cassidy. I am Vice President of Marsh and McLennan, Inc., and Director of the Aviation and Aerospace Services office in Washington, D.C.

I greatly appreciate the opportunity to participate in these important hearings on the issue of insurance capacity and its impact on commercial space activities. I wish to compliment the Subcommittee for its continued support for the commercialization of space, and specifically for the interest it is showing in the commercial risks associated with doing business in space.

Marsh & McLennan has been providing space insurance brokerage services to private industry and governmental organizations for the past twenty years. We are fully cognizant of the importance of insurance in protecting space assets, and the extent to which owners, operators and users, who are dependent upon space systems, have found insurance to be a vital resource for their business.

Essentially all commercial and non-U.S. government satellites launched into space are insured during at least the launch phase for physical loss and damage to the satellite and launch vehicle. Many are also insured during their on-orbit operational lifetimes. The extent of space insurance is reflected in the fact that, to date, the cumulative value of insured launches world-wide is approximately $5.7 billion.

At this time of dynamic growth in satellite usage and with increasing expectations for demand in on-orbit space industrial development, the insurance industry has been battered with large losses. The years 1984 and 1985 have produced space launch and in-orbit losses involving seven major satellites with combined insured values of approximately $600 million. The combined premium paid for the insurance covering these launches averaged less than ten percent of their values. This result has substantially degraded the accumulative loss ratio since 1978 to approximately $840 million in losses for $430 million paid in premiums. In terms of net premium to insurers, this represents about a $500 million net underwrriting loss position.

The current status of the space insurance industry is reflected in its present capacity to insure. Two years ago space insurance capacity was $250 million to $300 million per launch, at a premium rate of 5 to 7 percent. Today, there is about $50 million to $75 million per launch, at premium rates in excess of 20 to 25 percent. However, space insurance as with any form of insurance is subject to market conditions and failure to manage risks effectively can severely restrict its availability. I believe that with appropriate corrective actions, within the next 12 months space insurance capacity will begin to recover and return to the historical high in 2 to 3 years.

Mr. Chairman, the situation we are in today is the result of complex factors. Although there are no easy answers to the problem, we must seek solutions which enhance our ability to conduct commerce in space in a manner which permits the existance of a viable space insurance industry.

The current problem is the result of satellite and launch vehicle failures being coupled with accelerating space insurance values and to some extent with the fact that space insurance underwriters have been charging premium rates below the historical failure rates of launch vehicles and satellites. Clearly, if higher premium rates were charged, there would be less underwriting deficit today. However, there was at the time (and let us all hope it continues) great expectation among insurers in the future of the space business. The matured launch systems were achieving impressive records, the manned Space Shuttle was coming on line, and relatively large premiums were being paid for launch coverage.

Optimism of space insurers was further enhanced by the growing demand for premium dollars in the general property and casualty markets of which space insurance is one component. Underwriting losses in the insurance industry were being turned into net profit from high investment income earned on premiums. Unfortunately, investment income could not keep up with the underwriting losses in recent years with the result that current space insurance problems are now compounded by the state of the overall insurance industry.

The nature of the insurance market is cyclic. Similar conditions will likely occur in the future. Past losses will be written off, the insurance markets will respond to periods of good fortune, attract capacity and underwrite at premium rates which reflect current conditions and competitive forces. For this to happen in the space insurance industry, however, it is necessary to show that the risks of space can be managed in a commercial sense which implies limitations on the magnitude of exposure as well as the frequency of failure.

To ensure adequate insurance capacity for future commercial satellite launches, it will be necessary to improve loss experience and regain underwriters confidence in the repeatability of space technology and know-how. Underwriters must be convinced that they can make a business of space. I believe that this can be done and that actions by both government and private industry will contribute to achieving this objective.

During this period of recovery more demanding underwriting requirements will be imposed with additional emphasis on parameters affecting exposure to failures and potential magnitude of casualty losses. Clearly, further efforts by private industry must be made to improve reliability and reduce risk by stringent adherence to quality and process control, maximum use of proven systems and procedures, and minimization of system complexities. I believe manufacturers and systems operators are keenly aware of the problem and will be making every effort to improve their product where it is reasonable to do so.

On the other hand, it may be that the nature of space systems are such that failures are sufficiently random and inevitable, and that risks should be spread over more events to minimize the consequences of failures. It has always been the concern of space insurers that insufficient actuarials existed to accurately assess loss potential. There just were not enough launches and satellites. Recent trends, however, have been to further reduce the number of launches by putting more transponders on a single communications satellite and launching two or three satellites per launch vehicle.

In the near term, satellite manufacturers and operators are confronted with existing space insurance market conditions. The higher premium rates offer some prospects for either attracting new commercial insurance capacity or encouraging arrangements for mutually sharing risks through financial pooling.

Since we believe the situation is temporary, the government should not intervene into the marketplace or take any action which may chill the prospects for insurance market recovery. Such actions may leave little hope for a viable commercial market in the future, create an imbalance in the allocation of risks and establish a reliance upon insurance not driven by commercial market conditions but the availability of federal appropriations. It is worth noting that if a government pool had provided the insurance for all satellites launched on U.S. launch systems in 1984 and 1985, the Appropriations necessary to pay claims above premiums collected would likely have exceeded $350 million, further adding to the federal budget deficit.

The government has been the catalyst for the advancements that have taken place in space commercialization. The government role will continue to be substantial in all aspects of space commercialization including systems development, operations and regulations. I suggest that now may be an appropriate time to review the various government policies affecting commercial uses of space. The Space Shuttle is a great success, with unique qualities for commercialization opportunities, and NASA is now developing the Space Station with still further advancements from which commerce can benefit.

Although the actual implementation of government policies can be quite complex involving domestic and international interaction, it may be possible to rebalance interests to better accommodate the needs of private enterprise. From the viewpoint of having adequate insurance available to reasonable cost, this could manifest in less costly commercial space projects, and less accumulation of values exposed to any one space risk. In this respect the FCC may wish, for example, to reassess policies on full spectral utilization or other requirements which may be forcing licensees to larger satellites. Less expensive space segments could also lessen the burden on new start companies trying to obtain financing which must make a giant step instead of incrementally phasing into the communication satellite business.

NASA also may be able to reassess its procedures for STS manifesting in order to further reduce the number of insured satellites launched at one time. The large cargo bay of the STS provides the capability to accumulate very large values of payload, although NASA has judiciously been able to limit the cargo to three insured satellites. Space Station architecture should also be carefully scrutinized to minimize conditions which could force the accumulation of unreasonable large commercial value. In more general areas, NASA might also be encouraged to expand its various space technology programs and direct activities toward the specific needs of commercial satellites. Possible areas include improving space systems lifetimes, enhancing space materials performance and quality assurance, and defining the parameters of space electrical discharge phenomena.

In addition the Department of Transportation should be further encouraged to establish regulations and facilitate an operational environment conducive to private

investment in commercial single launch systems. DOT has expressed the importance of these systems in alleviating some of the space insurance problems.

In conclusion, Mr. Chairman, it is my belief that the great promise for substantial benefit on earth from space depends on the will and imagination of the private sector, with the cooperation and continued support of government. For commerce to expand in space, commercial conditions must exist with private investment exposed to minimum intervention and competition from government. Viable insurance coverages are necessary ingredients in the equation for commercial space. I believe that the space insurance market will respond to the need, although the industry must see opportunities to achieve profitable results in the future. The role of the government in space commercialization should not be that of insurer, but to foster an environment which accommodates the needs of private enterprise. Where government had control or substantial influence over these activities, it should recognize, consistent with national interests and objectives, that management of risks within commercial standards are necessary in order to allow space insurance to exist in form and capacity for the future.

Mr. Chairman, this concludes my prepared statement.

Mr. SIMONOFF. Thank you, Mr. Chairman, for inviting me to be here. I am not going to read my statement. It is in the record. I will give a summary of the statement.

As I said in my statement, the views expressed are strictly my own, and not those of my employer.

The question, can space projects be financed today? The recent underwriter withdrawals, or suspensions of assuming space risks due to the recent losses, have made it virtually impossible to finance new satellite systems for all but the largest domestic companies, and foreign Governments.

Today's systems are so expensive that without insurance, space investment opportunities would not be competitive—the word is competitive—with other opportunities.

With small companies, financing sources would be unwilling to provide funds. Large companies, although they could obtain financing, would have to face adverse stockmarket reaction to a large property or casualty loss, and most people don't realize the purpose of launch insurance for a publicly traded company is not to recover cash, but to prevent adverse stockmarket reaction, since the cash is already out and generally they have back-up hardware, anyway.

Question: Are insurance rates too high? I am persuaded that today's high rates will still permit commercial financing of systems because the rates are still a very small portion of today's total system cost. A "typical" two-satellite system with ground spare, with, say, a $250 million space investment, would most likely have a ground segment investment of four or five times as large.

On this basis, an increase in lauch rates from 5 to 30 percent would cause increases in total system costs from .7 to 4.1 percent, or .5 to 2.9 percent, respectively.

What are alternatives to insurance? Suggested insurance alternatives are substantially manufacturers indemnities, self-insurance, supplier and user-funded special insurance pools, Government subsidies of launch rates, and tax credits for losses.

When financial constraints, capacity, simplicity—and I stress simplicity—and flexibility are considered, no alternative is as attractive as perserving the present system and allowing it to make the appropriate adjustments to the change in its market and its structural deficiencies.

What should be the Government goals? I am persuaded that that there should be a Government industry cooperative solution to enable growth of underwriting capacity.

The underlying goals of any Government participation should be: One, creation of a temporary mechanism where the private insurance market can ultimately be the course of commercial insurance; two, no long-range cost to the U.S. taxpayer; and, three, no competition with, and no new regulation of, the insurance industry by the Government.

How would such a support work? An insurance fund would be created to support new commercial projects for the next 3 years. The size of the fund would be determined by an appointed Government administrator. The user would obtain to obtain insurance for a project through a commercial broker.

If an underwriting shortfall occurs, the broker would then apply for supplementary insurance. After a technical review of the project, the Government entity would accept the supplementarl risk at a fixed surcharge over the highest quoted rate. And, in this case, I mean the market rate—whatever the user can obtain.

The Government administrator would periodically review the state of the insurance market, either through the relevant broker or brokers involved in similar transactions, and determine if rates had risen. If so, the administrator would raise its rate to a level higher than the highest commercial rate for similar risk.

If the commercial rates fall—that is because the market is recovering—the goverment would not reduce its rate. Instead, the insured would be given the opportunity to replace the high-priced Government component with cheaper commercial support.

The Government would then return the premium to the insured, with interest, but less a charge for the backup service provided.

Again, all transactions would take place only through brokers.

Where should the activity be lodged in Government? Financial and operating responsibility should be placed in an existing organization within the Government, such as Treasury Department, or Overseas Private Investment Corp. (OPIC), which is profitable.

Technical risk assessment should be the responsibility of NASA. They have demonstrated an outstanding history of quality control. Involvement in this activity gives private sector access to this experience.

Should the system be limited to the U.S. Government or should it be multi-lateral? I recommend a multi-lateral approach with ESA and others for two reasons. One, U.S. payloads fly on ariane launch vehicles, as well as European payloads on the shuttle. And, two, the commercial insurance market is a worldwide market. Insuring an all-American launch has not been possible without European participation.

If an ariane would fail with insured non-American payloads, commercial capacity for larger American payloads on the shuttle, or commercial ELVs would suffer.

What should be the role of private industry? Commercial participation would consist of risk-sharing and supervision by a Board composed of a substantial number of industry members that would function either as directors or advisors.

What if there is no private underwriting capacity for anyone? At that point, NASA would set a rate. The insurance would be written, and then the rate would be scaled upward as the market recovers.

Finally, insurance should be treated as a scarce resource. There has to be a change in the atmosphere between users and underwriters—to protect the underwriters and make sure that adequate revenue is here for the underwriters to recover.

Thank you.

[The statement follows:]

STATEMENT OF JEROME SIMONOFF, VICE PRESIDENT, CITICORP INDUSTRIAL CREDIT, INC.

My name is Jerome Simonoff. I am a Vice President of Citicorp Industrial Credit, Inc. and Citibank, N.A. I am involved in the commercial financing of various space projects. The views expressed in this testimony are strictly my own and do not necessarily reflect any authorized or official Citicorp views.

The Insurance Problem

The recently announced withdrawal or limits on underwriting for space launch insurance accompanied by more than $600 million of cumulative underwriting losses are bringing to the surface a problem that has long been with us: the fragility of space insurance supply. There is adequate capacity in the debt and equity markets to fund growth of the space industry. However, without an assurance of adequate insurance underwriting capacity, there will be little or no funding because space investment opportunities will not be competitive with other opportunities.

In my testimony, I wish to discuss the financial implications of an insurance capacity shortfall and suggest that there should be a temporary combined Government industry cooperative solution to enable growth of the industry. The underlying goals of any Government participation should be:

(1) creation of a mechanism where private insurance market can ultimately be the source of commercial insurance,

(2) no added long range cost to the U.S. taxpayer, and

(3) no new regulation of the insurance industry by the Government.

Most opinions that I have seen have had two basic elements: (1) today's premiums are too high and (2) there is insufficient assured capacity to enable financing.

Are Today's Insurance Premium's Too High?

The previous history of profitability followed by concentration of losses indicate that perhaps the previous premiums were not high enough. If underwriters could have been viewed as excessively permissive to be in their current condition, it must also be remembered that they invariably supported industry leaders who had (and still have) good reputations for quality control. Where their problems have arisen have come from the inability to develop a sound actuarial base due to the low frequency of launches, and their high individual values. Essentially, losses due to low insurance premiums reflected the success of early launches followed by a concentration of high value losses.

I would further maintain that the sharp increases in quoted rates from the 5% to the 30% range, while high in absolute terms, are not high enough to be viewed as excessive in the context of the value of the total systems cost. In communications satellite systems, for example, the value of the investment on the ground is usually substantially greater (3 to 5 times or greater) than the investment in space. This allocation of investment would supress the effective total percentage of increases in insurance premiums. The "high" increases in insurance rates have actually brought about an effective two to four percent increase in total costs for systems with ground investment levels that reflect any reasonable distribution capability. An example is shown below:

Hypothetical Communications Satellite System

(2 Satellites with One Ground Spare)
(Launched Cost per Satellite before Insurance $85 million)
(Total Space Investment*: $255 Million)
(Total Insurance Premium for Two Launches 5%: $ 8.5 million
30%: $ 51.0 million)

Ground Investment	Total Investment	Insurance Premium 5%	Insurance Premium 30%	Percent of Total Investment 5%	Percent of Total Investment 30%
$ 0.25 Bil	$ 0.51 Bil	$ 8.5 Mil	$51.0 Mil	1.67%	10.00%
0.5	0.76	8.5	51.0	1.12	6.71
1.0	1.25	8.5	51.0	0.68	4.08
1.5	1.75	8.5	51.0	0.49	2.91
2.0	2.25	8.5	51.0	0.38	2.27

* Excluding interest and insurance premiums

Is Capacity Adequate?

The announced withdrawal or suspension of quotes by several underwriters for supplying launch insurance makes this question moot. Today, it is extremely difficult, if not impossible, to obtain a reliable price quote for a usable amount of launch insurance. However, I would maintain that there has been inadequate capacity for some time. It had been the opinion of many brokers, even before the recent group of losses, that it was not possible to completely insure a fully loaded Shuttle bay which would contain three or four delta class communication satellite payloads. In fact, it has been reported that capacity peaked at $260 million in 1983, almost the value of three communication satellites. While there have been disagreements among brokers and underwriters what precise amount of available capacity had been, certain characteristics of shortages were observable:

Not all commercial payloads that were recently launched on the Shuttle with three satellite cargoes were fully insured;

It was previously difficult to obtain an insurance commitment two to three years prior to launch when construction payments were required;
It was not possible to obtain multi-year in-orbit operating (or "life") insurance commitments beyond an initial three year period.

The strong capitalization of American buying companies or foreign government ownership of satellites, and the limits of applications to communications masked the potential problems on financing space development. Had the sponsors of the satellites been start-up companies, or had been major companies using "project" financing - a technique generally used in large capital projects, or had the applications involved in-space manufacturing with many rendevous with the Shuttle, the difficulty of financing would have become more apparent.

Would an Insurance Shortage Stop Investment?

Financial constraints beyond the buyers' own willingness to risk losing $100 million per launch would probably not limit the decisions of foreign buyers to purchase satellites because most of them are government supported telecommunications organizations. The ability to repay loans that support the importers' purchases of the satellites depends more on the countries' abilities to generate foreign exchange through exports than through local revenues generated by the communications systems.

For American buyers, however, financial constraints would place a very significant role in a decision of companies to go forward to build and launch uninsured satellites. For small companies, financial constraints would be placed on the buyers by investors and lenders. For larger companies, the constraints would be placed on the decisions by the management considerations of the effect of a casualty loss on the companies' stock prices which would, in turn, affect their ability to finance other activities. With the exception of only one or two of the

largest corporations, the effect on their earnings growth would be visible enough to make the companies question whether they would be willing to risk an adverse stock market reaction to a casualty loss. The Appendix discusses in greater detail the financial considerations these companies would face.

The Appendix also provides several alternatives that have been proposed in place of insurance. Given the alternatives available, it appears that without insurance in a form similar to what has existed in the past, the companies' managements could make rational arguments for not going forward with space projects.

The Government Policy Goal

After reviewing the financial implications of the insurance alternatives available, I have come to believe that any Government support should have as its goal the preservation of the present insurance structure. No alternative has had the depth of funding, flexibility, or management capability as does the current system. Furthermore, it should be the responsibility of the manufacturers, users, insurance suppliers, and government to work together to preserve the system.

What Should Government Operating Principles Be?

To meet the underlying goal of ultimate recovery and reliance on the existing, commercal insurance markets, Government support should be based on the following premises:

(1) There should be no Government regulation of the commercial insurance markets;

(2) There should, with only limited exceptions, be a minimum amount of commercial participation in the underwriting. The Government should not take the full underwriting risk in most cases;

(3) The Government should have the unconditional right to refuse any underwriting request for technical reasons;

(4) The Government should not compete with commercial sources. This means that the Government underwriting pricing should be higher than commercial alternatives, on a floating basis if necessary, and should stand ready to be replaced by lower cost commercial insurance, if available.

How Should the Support Work?

An insurance fund would be established of a suitable amount to be determined to support commercial projects undertaken in the next three years. The size of the fund would be determined by the Government Administrator and would be based on the value of the estimated launches and a conservative assessment of their actuarial success.

Once established, a user would attempt to obtain insurance for a project through a commercial broker. If there is an underwriting shortfall, the broker would apply for supplementary insurance, providing pricing information of the highest underwritten portion. After a technical review of the project, the Government entity would agree to accept the risk and provide the supplementary insurance. The Government would then offer the coverage at a fixed surcharge over the highest quoted rate.

The appointed Government Administrator would periodically review the state of the insurance market, either through the relevant broker or brokers involved in other transactions, and determine if the rates for the relevant risk have risen. If so, the Administrator would raise its rate to conform to a level higher than the highest rate for similar risk.

If the rates would have been found to have fallen, the Government would not reduce its rate. Instead, the insured would be given the opportunity to replace the high priced Government component with cheaper commercial support. The Government would then return the premium to the insured with interest but less a charge for the backup serevice provided.

Again, all transactions would take place only through brokers.

Where Should the Activity be Lodged in Government?

No large organization should be created for this activity. Ultimate financial and operating responsibility should be placed in an existing Treasury organization or an organization within the Government such as Overseas Private Investment Corp. (OPIC). (This is a Government organization that insures exporters political risk and reports that it operates at a profit.)

Technical responsibility and risk assessment should be the responsibility of NASA. This organization has demonstrated an outstanding history of quality control. Involvement in this activity gives private industry access to this experience.

Should the System be Limited to the U.S. Government or be Multilateral?

I would prefer to make this activity a multilateral one with E.S.A. and a European financial counterpart participating when Ariane launches are used. Other nations who provide launch service can join later if appropriate. I would recommend the multilateral approach for two reasons:

(1) U.S. payloads fly on Ariane launch vehicles as well as European payloads on the Shuttle.

(2) The commercial insurance market is a world-wide market. I do not believe that insuring an all-American launch has been possible without European participation. If an Ariane would fail with insured non-American payloads, commercial capacity for later American payloads on the Shuttle or commercial ELV would suffer.

What Should Be the Role of Private Industry?

Commercial participation in the risk underwriting is the ultimate form of providing a role for private industry. In addition however, I would propose that private industry have an integral role in the operation of this activity. This can be done by having the cognizant Government agencies subcontract certain appropriate activities to companies in the insurance industry. I would also recommend that the operation be supervised by a board composed of a substantial number of industry members that would function either in the capacity of directors or advisors.

What If There Is No Private Underwriting Capacity for Anyone?

No available assumable risk ("insuring a burning building") means that the required premium would be nearly equal to the possible loss adjusted for the time value of money. Under this circumstance, where previously, successfully insured payloads are involved, NASA would establish an appropriate rate that would be adjusted upward from time to time as commercial capacity becomes available.

Conclusion

The insurance industry has borne a tremendous portion of the burden for supporting the growth of commercial space. Perhaps, insurance has not been treated as the scarce resource that it actually is. There must be adequate insurance to make investment in space activities competitive with other opportunites. Without cooperation between users, suppliers

and insurers, just bringing the Government into the insurance business to fill a shortfall simply would create a further outlet for losses and create the same pressures for Government withdrawal as those that the commercial underwriters have experienced. I hope these parties can work together to make the Government role effective and temporary.

Appendix

Classes of Suppliers of Funds

Before I compare some alternative suggested solutions to the insurance problem, I would like to discuss some general financial fundamentals to place the insurance issues in perspective.

As we all know, investment in space requires unusally large amounts of capital for start up activities. This capital is provided by investors, who take calculated risks against expected returns on their investments, and by lenders who provide funds to essentially bridge the time delay between the outflow of funds and revenue collections by the borrower.

Types of Investors

Investors in space projects have different levels of acceptable risk and profitability standards. An investor who has been involved in related activites to the space investment, say an aerospace manufacturer or potential user of the product of an in-space manufacturing process, may have a vested interest in the project. The company may need the project to enhance or protect other business activities. This investor will take, perhaps a lower return, longer payout and higher risk, and may make larger, more concentrated investments than would others who have no collateral interests. Passive investors with no such related interests such as pension funds, the public, venture capitalists or other institutions may have higher standards with regard to size of return, speed of payback and level of acceptable risks. These groups will, in the future most likely be the source of funding for the most innovative, entrepreneurial, small organizations. Even those with vested interest, however, are not fully immune to the standards of the passive investors since their own shares are held by the passive groups.

Investors funding a project may or may not be indifferent to whether they receive dividends or allow them to remain in place to support its growth. When investors allow their funds to remain in their venture, they will generally seek their returns either in appreciation of the stock price of the venture or in their own stock price when the project's earnings are reflected in their own earnings.

When investors seek returns through their own stock price appreciation, they will seek to maximize both their own stock price and the stock price relative to their own earnings. Maximizing this ratio will require presenting a view to their own stockholders of rapidly growing earnings with the lowest possible risk. The generally accepted proxy for low risk is smooth, predictably increasing quarter-to-quarter earnings.

Lenders

Space projects must compete with non-space related investments on the basis of risk and profitability, the rate of return. This figure depends both upon the degree of profitability and timing, the rapidity of returns. With large investments required for space, competitive returns may not be available because the necessary profit levels could only be obtained from unrealistically large, rapidly growing revenues. Given the magnitude of investment involved, normally it is not possible for a new market to develop rapidly enough to provide competitive returns to more conventional investments.

Therefore, to obtain a competitive return, the investment must be reduced, either by reducing the scope of a project, which may compromise long term ultimate viability, or by replacing some of the investment with low-cost debt. This latter use of leverage is in fact the mechanism that most large investments require, whether they be communication satellites, oil pipelines or electric utilities. When, however we introduce debt, we also introduce the class of funds suppliers who are most risk averse.

Lenders, unlike investors, have a much lower acceptable level of risk. They advance funds anticipating that their loans will be repaid either through cash generated by the borrower's committed or highly predictable revenues or by replacement funds from other lenders who are satisfied that interest payments can be made. Therefore, the large size of space derived investments creates an interesting paradox: some of the most technically advanced projects can have no more risk than the level that is acceptable to the most conservative, risk averse suppliers of funds, the lenders.

Proposed Alternatives to the Present System

The current perceived concerns have brought about several suggestions on bridging an insurance gap. I would like to list some of them and the finsncial implications of each one.

Three important points: First the question of availability of insurance is relatively rare in financing issues. Usually, it is assumed that there will be adequate capacity. Second, the insurance industry has performed well in the past, but is faced with a perception, not a proven performance problem. Third, the question of perception focuses around availability and price, not the surety of payment when a loss occurs.

Some alternatives to fragile capacity are listed below:

(1) Assume casualty risk: A company would invest in a system as it does today, but would assume the casualty risk. This might be a reaction to high insurance rates or capacity deficiency. From a financial institution's standpoint, the probability of supplying funds to this venture would be very slim. Debt sources, which are necessary for large scale projects to enable investors to meet competitive rates of return on their investment, do not take casualty risks. This means that from an outside supplier's viewpoint, only the largest companies with the ability to absorb a sudden $100 million loss would be able to obtain financing. However, the companies' managements would have to agonize over accepting such a risk. There are few if any companies in the United States today where such a casualty loss would not have a material effect on either its earnings or predictability of earnings growth rate.

(2) Self insure: Under this scheme, a user would reserve funds to replace the launched satellite. (Note that ground spares are currently bought today when buyers obtain insurance.) Reserve funds of this size would represent a substanal amount of idle assets. Assuming that a satellite plus launch service would require a $100 million investment, the amount of idle assets would be big enough to hamper the financial performance of all but the largest companies. Given a company with $500 million of reported assets, the insurance reserve would represent 20 per cent of the total assets. Under this circumstance, the interest or opportunity cost of carrying idle or underperforming assets of this magnitude would compromise the company's earnings and adversely affect its market value.

(3) Require vendors to provide product liability indemnities: Under this arrangement, the cost of loss would be borne by the vendor whose equipment failure caused the loss. This liability is quite commonly found in the most commercial procurement. However, it is not realistic in the context of the high costs of space. A manufacturer of a failed sub-assembly might have a $100 million liability. Given the size of the potential loss relative to the the size of the vendor's contribution or total size, such a policy would probably cause suppliers to avoid the commercial space market altogether. Even in commercial non-space markets, virtually no company would operate in a business with a high potential liability without insurance.

(4) Create an industry sponsored pool to supplement or replace insurance underwriting pools: Each supplier would contribute funds to a pool to create a reserve fund to provide launch insurance. The question here is depth. It takes relatively few losses to require substantial amounts of money. Used in conjunction with other forms of insurance support, this structure would have merit. However, the magnitude and profitability of the space business could not enable such a pool to stand alone.

(5) Provide Special Tax Credits for Casualty Losses in Space: This concept is simple, requires a minimum organizational change in the Government, and can be implemented quickly within the current tax legislation revision process. Unless the tax credit would be uniquely tranferrable, or "marketable", the concept would have the problem of not helping a capital intensive taxpayer who would be well sheltered, a new entrant who probably would not have sufficient earnings to employ the tax credits, or a foreign buyer of American launch services. The concept transfers some risk to the American taxpayer.

(6) Create a Government vehicle to provide low cost insurance rates: This concept involves having the Government act as an insurer or providing premium subsidy payments to allow new companies to enter the space business. The implication of this assumption is that insurance premiums have to be too high to enable the insurers to "catch up" and become profitable. While it is not clear what the implications would be for future in-space manufacturing, it is apparent that in the communications satellite business, the subsidy would probably not substantially increase the number of entrants. It is possible to make nearly "normal" profits even at today's high rates. This is because the capital in terrestrial segments is substantially larger than the space segment. Thus the overall effect of high rates is supressed in the total investment. Low rates with Government provided underwriting would probably prevent a growth of underwriting capacity. The implication of such a policy would inhibit financing because insurance capacity would not grow.

(7) Create a Government vehicle as an insurer of last resort: The author has previously recommended this vehicle as a temporary measure until the private insurance market becomes cumulatively profitable. In this case, the Government would charge a rate higher than the highest quoted commercial rate. Furthermore, there would be no Government provided insurance unless ther were partial private insurance participation. This system would require no taxpayer subsidy, as long as there were limited losses, and would allow the private markets to set their own rates. This system would not be a substitute for private insurance, but would offer insurance over terms that extended beyond the normal tenures of insurance policies. This would, in turn, allow long term financing because the funding sources would not be dealing with a perceived insurance availability risk.

(8) Government and Industry Should Cooperate to Preserve the Present System: The present system has shown its flexibility and resiliency by continuing to provide insurance in the face of mounting losses. Furthermore, the market is an international one and has been willing to accept risks in amounts far greater than those that could be provided by alternative commercial sources. To function on a long term basis, the system is going to have to be cumulatively profitable.

Users should have the attitude that insurance is a scarce resource that should be protected. This means that users should be willing, for the near term, to pay high in-orbit operation rates while the cumulative profitability record recovers. Manufacturers and users should create the private pool (option 4) to enable only partial underwriters' payouts (while obtaining full insurance coverage). The pool should be used only as a temporary supplement and not as a replacement for normal sources.

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Senator GORTON. Thank you. Mr. Hewins, to what extent have satellite operators, up to this point, been required to co-insure or self-insure their payloads, and what co-insurance or self-insurance do you see in the immediately foreseeble future?

Mr. HEWINS. In the last 2½ years, the number of projects have gone—since 1980 to about 1983, I don't think there are any real co-insurance or self-insurance projects in space. After the losses in February of 1984, I know of at least three that have done that—three other launches that I am aware of.

Senator GORTON. Co-insurance or total self-insurance?

Mr. HEWINS. Self-insurance above a certain limit, and the reason being that, one, they are not willing to pay the rate that was charged, and I think also there has been a reassessment on the part of the operators on how much insurance they can buy. In the early 1980's, you could buy insurance very cheaply—5 percent of the sum insured, so I think the sums insured were slightly inflated.

Senator GORTON. What about the immediate future?

Mr. HEWINS. I think that you have a potential—in fact, you have a situation right now down at the Cape. There are three satellites on the next launch, scheduled for November 27, two of which are insured, and the third is not insured and I don't believe they have any insured placed yet. They may have to go self-insured at this moment.

Senator GORTON. Has this changed affected the development of satellites?

Mr. HEWINS. It is affecting a couple of projects that I know of, that are entrepreneurial projects. The FCC has said as part of its rulemaking, that they wanted to see insurance as part of the equation, and the financiers, such as Mr. Simonoff, have said that if they can't get guaranteed insurance as part of the project, they won't go forward.

I know of one project that is scheduled for launch middle of next year, I think, on ariane that is having that type of problem. It is a balancing acting of trying to keep the project going until they can get guaranteed insurance for the launch.

I haven't seen any project, in particular, be shut off because of it, but it has come up more than once and it is getting more frequent.

Senator GORTON. This next can be for any of you who wishes to comment. I understand that one response to the current dilemma has been that the aerospace industry form pools for group risk-taking.

How will pools of this nature affect the satellite insurance industry, and is there widespread interest in the aerospace industry in forming those pools? Any downsides to the formation of such pools?

Mr. STOCKWELL. It so happens that about a year ago, the organization I am associated with attempted to set up such a pool, in calibration with one of our clients. We found at that time an interest, but really not a hundred percent willingness to go through the aggrevation that was necessary.

You need to five, six, seven, eight or more people with like interest, like values, and flying within a reasonable span of time. It is possible, but it is not easy. I suspect that given the situation that now exists I

year later, there will be a lot more willingness to participate and to compromise than there was a year ago.

Senator GORTON. Anyone else want to comment? Mr. Simonoff?

Mr. SIMONOFF. A manufacturer-provided pool would be very, very severly limited in the size that is available. It is an aspirin. The market, i.e., the number of manufacturers is too small, they are too few in number. The profitability is too low. They could not support a pool. Also, they have conflicting interests.

May I add one point here of interest? To give you an idea of the fragility of a pool, this is very similar to self-insurance. The comment was made earlier about how a manufacturer might assume some certain insurance.

If you look at the effect of the casualty loss on even the largest companies in the country, they cannot sustain these types of things. If you look at General Motors, its third quarter earnings grew 20 percent. This is generally a soft quarter for the company. The company does better at other times.

Had the company taken a $40–$50 million-after tax loss, due to the failure of satellite in launch, their earnings growth would have fallen from 20 percent to 8 to 10 percent.

Had AT&T done the same thing, their third quarter growth would have fallen from 18¾ percent, to 3 to 6 percent.

Now, at that level of adverse effect on the stock price, I doubt very seriously whether the corporate board members would allow the operating divisions of these companies to take the risk inherent in self-insuring a satellite.

Mr. CASSIDY. Mr. Chairman, if I may make comment on the pool concept. As mentioned previously, there certainly are problems with such an approach. This is a difficult time also because of the higher rates. There are also a limited number of possible participants for such a scheme.

One thing one would want to keep in mind, is that it would be, if such an activity was initiated, an industry solution. It would be a temporary type of solution which would be in addition to any commercial insurance that may otherwise be available. The way it could be structured would be the quota share-type approach.

I made the point earlier about relying on the commercial industry for insurance and not the Government. This would not be a Government program, but a group of satellite owners, or manufacturers that feel that they would like to pool, in the traditional sense, their risks, and share their fortunes.

Senator GORTON. Thank you. Again, any of you who wish to comment on this point may do.

I am told the commitments for satellite insurance may not be available any earlier than roughly 90 days before launch, a situation which obviously causes satellite operators and builders a degree of anxiety.

Obviously, the situation can affect the planning and financing for satellites and other payloads, because that is roughly a 3-year process.

Why is this the case, assuming that it is; is it likely to change?

Mr. SIMONOFF. I can speak to this from the financing side. I can't speak to the issue of why the underwriters won't go sooner.

With regard to exports of satellites, it is not an issue from the ability of a Government to buy a satellite simply because you don't look to the profitability of the satellite project; you look to the exports of the country.

Similarly, for General Motors or IBM—that size of company—they can do other things. That is not a problem. The issue that you are dealing with, however, is when you build a communications satellite, you have the question of completion risk.

The suppliers of funds want to be assured that if they start to advance funds to build a satellite or to buy launch services, which is generally 3-year period, that there will be insurance available in that third year so that when that satellite goes up they will receive funds.

Now unfortunately, today, you could not assure yourself of covering the completion risk because of the sustained loss of the market.

If I went to my management today, or if I went to other financing institutions and I said "Okay, the industry has assured me that they have solved their problems, they are going to go ahead—we spoke to all the brokers, underwriters; they have said they are on board."—I would be asked, "How do I know?" I could speak of assurances, and then the people would say—"they have lost money. If you don't know, how do they know?" The answer would continue, "Let's wait a couple of years to see whether on a sustained basis they can make money."

So that says you have a 2-year delay before a financing source would be inclined to advance the first dollar to start 3 years of construction. So, if you sit and wait without external support of something, or some extraordinary effort on the part of the insurance industry to get external support through other forms—if not the Government—you are talking a substantial slippage in going forward.

One more point—not to take too much time. The situation becomes exacerbated if you ever go into the in-space production issue—the manufacturing of platforms.

The way you would finance a production platform would be similar to the way you finance a ship. You would look for commitments to use the platform, and then on the basis of the commitments to use the platform, the financing source would advance three years of funds to build the platform. The repayment of the funds coming from the usage fees.

Now the usage of a platform involves several years of launches, which means you build a platform for 3 years, you then wait 4 years, 5, 6 or 6, but only insurance for 1 year of fees from launches are available to assure the repayment for the first 3 years of funding.

Now, before all these problems came up—before the 6-month or 3-month limit on quotes, you still, at best, have 3 years. It is still not enough. The insurance industry would say—we wouldn't go out and guarantee you availability for years 4, 5, and 6.

Now, if the insurance industry were showing sustained profitability, then the financing people would probably go with the risk and act on faith. But the sustained profitability isn't there, so therefore, you just can't even start to finance a production platform, which is really the future of where industrial space is going to be.

Mr. BARRETT. Mr. Chairman, I believe I am the only insurance underwriter at this table, and space insurance is the only thing that INTEC, my company, does.

To answer your question on why we refuse to put rates, promulgate rates, or fix the insurance until ninety days prior to launch, in the past, we tried to extend policies 2 and 3 years into the future. In doing so, we set a rate which, during the policy period—we would set a rate that might cover three or four launches of a particular satellite owner—and in doing so, we found ourselves trapped in the second and third years with events having occurred which greatly adjusted the expected reliability of the launch to which we were committed, and we were in no position to increase our premium rates.

That is one key issue. Another key issue is that re-insurance upon which the whole of the insurance industry, particularly the catastrophe insurance industry depends, cannot be fixed more than 1 year in advance. So, with the rapid succession of losses over the last 21 months, it is the feeling of underwriters that they should wait until pretty close to the moment of truth before guaranteeing that the rate on the insurance and the insurance will be available.

With regard to the 3 year problem, and we are very sensitive to this. We live and die with space commercialization. If it grows, we grow and if it fails, we fail.

So we are very much interested in fostering the enterpreneurial activities in space. We believe our new process of providing insurance greatly enhances the ability of entrepreneurial satellite owners to go forward. By asking the satellite manufacturer to deliver the satellite on orbit to the satellite owner. We consider him to be the goose that lays the golden egg.

It is the satellite owner who goes out to the financial markets and raises $2–4 million, and gives it to all the rest of us—he gives it to NASA, and he gives it to arianespace, and he gives it to the satellite manufacturers and he gives it to the underwriters.

So the goose that lays the golden egg is the owner of this satellite and he can, if he can ask his manufacturer that he selects, to deliver the satellite on orbit, he has no obligation at that moment to arrange insurance. That is, launch insurance.

We have demonstrated just in the past week that in the worst market that we have ever seen, a highly valued on orbit satellite system came to market and the market was able to provide well over $100 million of insurance—just last week. And that was more than the owner needed to cover his exposure to loss on orbit.

So we believe that the manufacturer is in a better position to control the probability of success of his satellite, achieving a successful ascent to orbit. We believe that the satellite manufacturer is best equipped to interface with the launching agencies, and to affect it successfully.

It is just like the shipbuilding business. If I go to someone as a ship owner to buy a ship, I ask it to be delivered to me in the water. We have a wonderful ceremony when it is launched, but I don't take title to that ship until it has gone through its sea trials and been demonstrated to be effective, and meeting specification.

Now the shipbuilder in that case buys builder's risk insurance, and this has been going on for centuries. They buy builder's risk insurance, which not only insures the value of the vessel on the shipways and under construction, but during the sea trials.

The shipbuilder is best able to deal with the risks of launching and trying the vessel.

We believe these principles need to be applied in space insurance which is, after all, only 22 years old.

Senator GORTON. The light that just went on is a roll-call. We are star-struck here today.

I have one or two more questions. I think I will turn this panel over to Mr. Perkins, as I did the previous panel, so that you can give your answers for the record, and then be on your way.

This will not be a long absence.

Mr. PERKINS. Mr. Stockwell, in your testimony you have stated underwriters have the perception, perhaps not without justification, that losses have occurred unreasonably, that claims have been made that have included an undue proportion of profit, and that the insurance industry has been used as a prop and as a substitute for true diligence. What is the basis for your position? And could the other panelists comment on this as well?

Mr. STOCKWELL. Thank you, Mr. Chairman.

First of all, I would repeat, it may only be a perception, but there are some numbers that perhaps are interesting. When we had the double loss last year of WESTAR 6 and PALAPA B- 2, the spacecraft were virtually identical. One was insured for $75 million, and one for $105 million, and there was a feeling, justified or otherwise, I repeat, that the difference was an unjustified difference. It represented an element of anticipated profit, perhaps. That might or might not be true.

It is very deep water, this conversation. One could get into trouble. But that is the perception. Losses that have occurred unreasonably? Well, I know the Hughes people are in the room, but the underwriters seem to think that the problems that occured with LEASAT 3 and hopefully LEASAT 4 subsequently represented perhaps undue incidence of problems with a mature design. We always expect failures, but perhaps not quite so close together as in this situation.

They are the two examples I would give in support of that position.

Mr. PERKINS. Do any of the rest of you have a comment?

Mr. SIMONOFF. The question of what is being insured, I think, should be clarified. You are launching a satellite for $100 million. You are not insuring the satellite. You are insuring the satellite plus the ground equipment, which, as I mentioned earlier, the ground investment might be four to five times as much.

The ground equipment facing an empty sky is of no value to anybody, so if that satellite is insured for $100 or $200 million, there is still an enormous de facto economic deductible in that insurance.

Mr. PERKINS. Mr. Cassidy, could you comment on the present launch insurance rate structure for the shuttle and ariane and account for any differences in the premium rates that might exist?

Mr. CASSIDY. Yes. At this point, since the last ariane launch, it looks like the market has more or less leveled out. I would rather have an underwriter answer this, because it really goes more to what his reinsurance perception is and so on. But it appears, at this point in time, things have more or less averaged out, and the market is reacting to the latest losses, so I would say generally there may not be a substantial difference in the two launchers. It may involve other factors such as the satellite and other perceptions of risk.

I did want to make one other point about the question of what is insurable and what adds up to a total sum insured. I do not know specifically about the two satellites that were mentioned before as to what the total values are, but it has always been accepted in the insurance business to consider business interruption as a legitimate expense which can be insured in the event of loss. We would like to look to the future when the market does recover and the capacity does increase. We hope that in fact this kind of coverage would continue to be available because, as Mr. Simonoff said, there is a ground system, there are people and there is a whole business that depends upon this mode in the sky, which essentially determines the business.

Also, one other point, if you will. I guess it is semantics a bit, but in terms of failure, clearly any failure, random or otherwise, if you investigate it far enough, you are going to find something happened, something failed. The randomness of failure suggests that you have done everything you can to eliminate potential losses, and there is nothing reasonable left that you can actually work on to uncover this flaw. And it could very well be that that is the nature of these systems. After all the testing and design reviews, and qualification, and production, you still end up with hidden flaws, which if they fail you can certainly find them, but, being random in nature they are not readily detected.

Thank you.

Mr. PERKINS. Mr. Barrett, I believe he wanted you to offer your opinion as well.

Mr. BARRETT. Thank you, Mr. Perkins. I do not know how you all live with this thing, actually.

Mr. PERKINS. I generally do not have to.

Mr. BARRETT. Well, the variance between ariane rates and shuttle rates, let's take the period of initial operations and set that aside, the manufacturer starts out with a satellite on the ground, which presumably has met all of its specifications and is tested out to be a flight-ready satellite, and the great hope is that after this very, very brief launch into space when they have subsequently deployed the antennas and so forth, that they turn the thing on, and it does still meet specification.

So, if we separate that as an issue for the manufacturers and for those interested in the satellite, then we are talking about the launch vehicles themselves. Mr. Stockwell has been talking about perceptions of risk. Underwriting is an inexact science. We have a tendency to frustrate engineers and mathematicians to no end, because the average high school math teacher can put some statistics on the loss rates over the events that have occurred, and comes up with what in his or her mind is what the premium rate should be.

But the premium rate is a function of a whole number of things, not only the statistical base, such as it is, very narrow, but the ability to attract reinsurance and some concept of what kind of premium rates must be available in order to attract reinsurance, an appraisal of the commercial situation and the terms of the insurance.

We apply insurance premium rates against coverage, not against a satellite or a rocket, but against the coverage that is asked for for that satellite or rocket. Some coverages are broader than others. Some have some participation by the insured. Some may be asking for too much insurance, and some may have a more modest requirement for insurance.

So, having said all of that, in order to set the stage for an answer which will undoubtedly be unsatisfactory to everyone, the bottom line is that they are very close. Underwriters' perception of risk right now, I think, with ariane losses being the most recent, probably does not favor ariane at this moment, and may indeed favor the shuttle, but it was only last February or let's say late in 1984 when I must say we thought that ariane was really in much better shape than the shuttle was.

Now we have a new upper stage coming on for the space shuttle, the PAM-D-2, which has not flown yet. We are concerned about that. I would be dismissed from my job if I weren't concerned about the flight of a new, very important upper stage which has a potential single point failure for a shuttle launch.

We are adding coverages which we now believe are absolutely essential to the shuttle. That is coverage to pay for the cost of recovery from orbit, and pay for the cost of repair on orbit. So, our perception of the cost of the shuttle and the cost of upper stages and the cost of apogee motors when they change and all of this causes us to modify our thinking about the shuttle.

I would say right at this moment we feel that they are close to equilibrium. There would be minor differences. And I believe that right at this moment, because of the timing involved, it probably favors shuttle over ariane. It can change with a single launch, though, can it not?

So, having said that, I wonder if I might just make a comment, though, about—we hear everybody talking about 14 percent rates, and we have not been able to make money at 14 percent rates. We have not been able to get 14 percent. The very people that are saying that we should have been charging 14 percent in 1982 and 1983 are the same people that were beating us severely about the head and shoulders to give them a premium rate of 6 or 7 percent.

So, that is a perfect example of the market realities in which we all live. Now we are at a situation in which we have taken a bath. My company has handed its reinsurers $100 million in losses. And if I am going to keep this company going and keep the 85 fine insurance companies that we underwrite for, if I am going to keep them available to everyone, I have got to show them some opportunity to make a profit.

So, the rates that we charge in the near term must be somewhat above that burning cost. I dare say that the 14 percent rates that are admitted to, and Mr. d'Allest, whom I respect greatly, I might add, is suggesting premium rates of 11 to 13 percent when he has said that they have a demonstrated loss ratio of something higher than that. I am confused by that.

I am confused by those kinds of comments. Why should we be putting forward premium rates that are lower than what everybody knows is the burning cost, and when we are in a position in which we have to attract capacity to the market, and the only thing that will attract it is money? It is axiomatic in a 300-year-old business that if the premium rates are there, the capacity will be there.

So, we have an unfortunate period ahead of us of probably extraordinarily high rates. Yes, rates which may turn out to be, may, and it is not guaranteed, that may turn out to be in the next 18 months marginally too high, but clearly, everyone has been very quick to point out that we have been marginally low for the last 2 years by maybe one order of magnitude.

So, I would be most grateful if all of those making these comments would be thoughtful of us in the future and help us to restore a market which not only benefits me and pays our salaries and our company, but hopefully will be available to them.

Mr. PERKINS. To follow up on your comments about the ariane relaunch policy, could the rest of you who care to comment on NASA's new relaunch policy, and also that of ariane's and how it might affect the satellite insurance industry?

Mr. BARRETT. I do not want to monopolize.

Mr. STOCKWELL. I made a remark in my speech just now that anything that anybody can do to remove risk from the market is going to help, and obviously arianespace proposal may do that one way and the NASA proposal, another way by reducing values. The question of the pricing policy of the shuttle is certainly not my field. The question of removing demand for capacity, via for example, the arianespace approach is another thing.

So long as it is a genuine removal, as I remarked in the paper, and people do not go out and try and insure themselves, in turn, but retain these risks, it will help. But for example, if the manufacturer is to warranty the products, it would do absolutely nothing, at least in the short-term, though it may help quality in the long term, if they simply turn around and insure that risk.

Mr. BARRETT. I believe my comments on that may be fairly well understood, but I want to make sure that they are. I think first I need to say that our company and for the most part all of the 85 companies

that we represent applaud and are fascinated with and really want to go forward with the aerospace industry, NASA, and arianespace in the commercialization of space and the exploration of space.

The reason they are here is because they want to be here. And they think that they have some possibility of making an underwriting profit. So we applaud the activities, irrespective of the losses of all of these men. We are very thoughtful of the success of certain manufacturers who have had bad luck in the past.

We are very thoughtful of the fact that arianespace may have had eight or nine successes prior to experiencing this loss. We applaud NASA for a successful 20 flights of the Space shuttle. What we are interested in doing is seeing that insurance not be a sort of whipping boy in between the competition between arianespace and NASA. We think that the two launching agencies should be competing on their own merits, on their ability to lift cargo efficiently and reliably.

And so we recognize that they are in a commercial business, and you say that you will give us service, and you fail to give that service, it is perfectly justified for the vendor to say, well, having not been able to give you this service the first try, I will do it again free, or at some reduced cost. I do not have any great problems with that. But I do take great exception to any launching agency who might choose to extend an indemnity to a satellite owner after the satellite has been successfully deployed from his launch vehicle. Why is he involved in that? I do not understand why they feel it necessary to be involved in that.

We simply cannot, even though I have got the Prudential and the Metropolitan and a few big companies in our fleet, there is just no way we can compete with the Federal Government on those issues.

Senator GORTON. Thank you all very, very much. You have been most helpful to us. I ask your pardon for the frequent absences of the Chairman.

We will now hear from our third and last panel, Dr. Waylan, Dr. Wheelon, and Mr. Langstaff.

Senator GORTON. Welcome to this hearing. I am afraid I am going to have to limit each of you to 5 minutes as well, because we are way over time. But of course, your written statements will be included in the record.

We will start with Dr. Waylan.

STATEMENTS OF DR. C. J. WAYLAN, PRESIDENT, GTE SPACENET; DR. ALBERT D. WHEELON, SENIOR VICE PRESIDENT AND GROUP PRESIDENT, SPACE AND COMMUNICATIONS GROUP, HUGHES AIRCRAFT COMPANY; AND DAVID H. LANGSTAFF, SENIOR VICE PRESIDENT AND CHIEF FINANCIAL OFFICER, SPACE IN DUSTRIES, INC.

Dr. WAYLAN. Thank you, Mr. Chairman.

I am Jerry Waylan, President of GTE spacenet Corporation. I am honored to have the opportunity to testify before this subcommittee on the subject of the impact of insurance availability on the commercial U.S. domestic satellite industry. I commend this subcommittee for its report on insurance and the commercialization of space.

GTE spacenet Corporation, headquartered in McLean, VA, is a wholly owned subsidiary of GTE Corporation. GTE has been involved in the domestic satellite industry since the early 1970's, when we, in conjunction with AT&T, developed a domestic satellite system using Comstar satellites. AT&T continues to use this system today with their Telstar satellites.

GTE spacenet's own current satellite system includes a total of seven satellites either constructed or partially constructed. GTE spacenet has about 400 employees in 13 States. We have three satellites currently in operation and plan to launch three more during 1986. GTE has a significant ground station investment in various locations in addition to that in satellites. This represents a substantial commitment to participate in the commercial satellite industry.

GTE spacenet serves numerous customers utilizing satellites for voice, data, and video services. We believe that satellites are uniquely well suited to provide many communications services in an efficient, cost effective manner, permitting users to have considerable control over the design and implementation of their networks.

This belief is bolstered by the many benefits which satellite communications have already brought throughout the world, such as widespread delivery of educational and entertainment television, improved long distance telephone service, and high speed computer communications.

I would like to turn now to the specific concern of this hearing, and that is the effect of the availability of satellite launch and life insurance on the future of the commercial domestic satellite industry. As you are all aware, GTE spacenet recently experienced the loss of its spacenet 3 satellite because of a launch vehicle failure. While we were distressed over the loss of this satellite, for which we had customer commitments, we were fortunate to be able to provide for most of these customers' requirements over the short term on our other operating satellites.

spacenet 3 was insured through a launch insurance policy that was placed in 1984. Although in the past we have had relatively little difficulty obtaining satellite insurance, there has been a significant lessening of competition in the provision of this insurance since the Westar and PALAPA launch failures in early 1984.

Following the failure of the ariane vehicle carrying spacenet 3 and the declarations of loss for the syncom or LEASAT satellites, we feel that there is no longer competition for the provision of satellite insurance. Furthermore, worldwide capacity for launch insurance appears to be substantially less than the amount of coverage needed. This means that satellite operators will either have to self-insure or obtain that insurance coverage, what insurance coverage they can, at excessively high rates.

The availability and cost of such insurance will certainly be a major factor in decisions to deploy satellites for continuing or new satellite services. This situation is quite likely to be a deterrent to satellite deployment, thereby diminishing the many new services and substantial benefits that satellites offer.

Because of the many contributions that commercial space activity provides, including adding to the United States' overall space capability and knowledge, such a slowdown in these private sector activities is not in the national interest.

In addressing what initiatives can be taken to rectify this situation, we have concluded that an important issue is where the risks lie in a satellite launch and who can best control the level of these risks. Conventional satellite launches to geostationary orbit can be considered to consist of several phases.

The first phase extends from liftoff of the launch vehicle to attainment of its assigned orbit and release of the satellite. The launch organization, such as NASA or Arianespace, performs this service for the satellite operator.

Another phase extends from this point until the satellite achieves its assigned slot in the geostationary orbit and becomes operational. The satellite manufacturer plays a primary role during this phase.

Traditionally, satellite operators have expended large sums to insure against risks during both of these launch phases, even though they have limited control over the design, manufacturing, and testing of the launch vehicles or the satellites.

However, these are the factors which largely determine the level of risk. The launch organization typically has most control over the risks involved in the launch phase. During the second phase, the satellite manufacturer has most control over that risk. Therefore, it is understandable that some insurance underwriters are pressing for the satellite manufacturers and launch organizations to take more responsibility for covering these risks.

In the current environment surrounding satellite insurance, it is necessary to reconsider the roles of the various parties involved in manufacturing, launching, and operating of satellites. First, both the manufacturers and launch organizations have many more events over which to spread risks than do individual satellite operators.

Second, placing more responsibility on these parties for covering the applicable risks provides the strongest incentive for quality control on those who have the greatest opportunity to exercise it.

The suggestion for reallocating the risk and insurance responsibility for satellite activities does not imply that either the manufacturers or the launch providers have been negligent in the performance of their roles. On the contrary, I believe that both industry segments devote substantial resources to quality control and are very concerned about attaining optimum performance. Nevertheless, a reallocation of risk can work to enhance the quality control measures, thereby reducing insurance claims. In the long run this will reduce premium costs and increase the amount of insurance capacity so that a competitive insurance market may again exist.

The satellite communications community must give serious consideration to shifting the burden of risk-taking from individual satelliite operators. Whether this is accomplished by pooling of risks by several operators, acceptance of risk by the manufacturers and launch

organizations, or a combination, I believe serious efforts should be made in this direction over the next few months, rather than the U.S. Government considering a Government-backed insurance program.

Dr. WHEELON. Senator Gorton, in view of the hour I would be happy to submit my remarks for the record and pass directly to questions, if that would facilitate your inquiry. On the other hand, if you want me to—all right? So be it.

[The statement follows:]

STATEMENT OF DR. ALBERT D. WHEELON, GROUP PRESIDENT—SPACE AND COMMUNICATIONS GROUP, HUGHES AIRCRAFT CO.

Mr. Chairman, I am Albert Wheelon, President of the Space and Communications Group of Hughes Aircraft Company. We are the world's largest supplier of communication satellites. More than half the satellites launched in the free world were made by Hughes. We have built and delivered 66 commercial spacecraft for both the U.S. and international markets. We have 13 more satellites under construction in Los Angeles.

In addition to building satellites, we own and operate six spacecraft in orbit through our wholly owned communications company, Hughes Communications, Inc. We have permission from the FCC to build and operate five more. Our communications company has been selected to supply and support the first commercial satellite system in Japan. We are negotiating with NASA for six additional shuttle launches which together with our spacecraft already in orbit will make us the largest private customer of NASA. These data are cited to emphasize our concern for the viability of the space market.

While the subject of your hearings relate to insurance on all commercial space activities, we will limit our remarks to the insurance of communications satellites. To date, it has been the only commercial success in space and it is our principal line of business.

Communications satellites are a major source of exports for the United States. The Europeans and Japanese are eyeing our space industry for themselves. It is a field where the U S. is still the acknowledged leader. Most of the satellites have been launched by NASA from Florida. Private industry developed and sold the satellites. NASA developed and provided the launch vehicles. The thing that will keep this business going in the U.S. is a continuation of successful relationships. The relationship grew, and continues to grow, from the collaborative efforts of four venture groups. The first is NASA, which developed the Delta and Atlas expendable vehicles and later the Space Shuttle. As users of launches on the early expendable vehicles, we worried about launch reliability and suggested that NASA provide some form of launch insurance. NASA adopted a "take it or leave it" attitude on risk which everyone reluctantly accepted. The second venture Group is the manufacturers of hardware. Hughes, RCA and Ford have spent their own resources to develop satellites. Satellite systems have been sold to Intelsat, Canada, Brazil, Indonesia, Japan, India, Australia and Mexico. The export value is in the billions. The third group is the operators. Western Union launched the first U.S. commercial satellite in 1974 without any assurances that it would be successful. Since then, SBS, RCA, ATT and Hughes have undertaken similar business risks. The fourth venture group is the insurance community, who provided financial stability to a high risk business. The availability of insurance coverage encouraged new companies to get into the business and has had a very positive effect on the space business. It is in the national interest that all four of these entrepreneurial groups remain in the space business.

The report prepared by the Congressional Research Office for your committee expressed a concern that the lack of insurance could hurt entrepreneurial space ventures. This may be the case in space ventures other than communications. In the communications satellite business, it should not be a concern because the capital requirements will probably preclude entry by small firms. A starter set of two satellites and associated ground equipment costs somewhere in excess of $300 million. As a manufacturer of hardware, we welcome all new entrants. However, the new entrant is more likely to meet financial rather than insurance constraints.

As you may hear from others, the thing that is causing the present insurance problem centers on the launching systems. Of the 20 major failures to date, seventeen involved rocket stages. With the development of the space shuttle, the perception of risk has changed. The shuttle represents the first two stages of the rocket. The astronauts who ride the shuttle assure high reliability of their part of the mission. As a result, the shuttle should continue to enjoy favorable insurance rates. The post shuttle rocket stages and the satellites are now getting most of the attention. In a way, the superb reliability of the shuttle is causing a focus on the remainder of the mission. The journey after separation from the shuttle to geosynchronous orbit is now viewed as the high risk component of the mission.

The problem in the space insurance industry today is that underwriters have paid out about $450 million more in losses then they have collected in premiums. This is a loss ratio of 2:1 and creates a temporary impression of disaster in the insurance market. Some underwriters have suffered large losses.

An examination of the claims data since 1977 makes a strong case for the old saying that "There is no such thing as a bad risk, only a bad rate." If premiums had averaged 14% instead of 7%, the insurance industry would have broken even and we wouldn't be here today.

Another change is that spacecraft are becoming larger, more complicated and more expensive. The insurance coverage on Intelsat III in 1968 was $4.5 million; current launches have satellites worth $75–100 million. Intelsat VI scheduled for launch beginning in 1986 will probably launch with a value of at least $150 million each. Any loss of this magnitude will get lots of attention regardless of the profitability of the insurance industry.

What is it we can do? As previously stated, 17 of the 20 major losses were in rocket stages. NASA has a continuing role to do what only they can do, namely improve the reliability of the rocket stages. That is its major potential contribution.

The manufacturers have a role. Hughes has always accepted penalties for problems caused by Hughes. We share the pain with our customer when satellites occasionally malfunction. As manufacturers, we have never insured these penalties. We believe in strong financial motivation for performance. We will continue to establish design objectives to improve the reliability of our satellites. We will work to reduce the losses below the historical rate of 14%.

The insurance companies obviously need time to catch their breath. We believe that they have abandoned space. When the market recovers, it may not include all the same underwriters. It will probably demand higher rates for the same capacity. Higher capacity will demand higher rates. The rate will be determined by intense negotiations among operators, brokers, underwriters and reinsurers. A classic case of the market at work. No two insurance policies are alike. Rates will rise to cover losses. We believe that the reliability will improve and we expect to see it reflected in the rates. This is part of the negotiation process.

Lastly, what is the role for government on the insurance issue? The specific risk is the large exposure of the satellite after it has left the shuttle. This is the part of the mission over which government has the least influence. There have been suggestions that NASA could undertake a surveillance activity on satellite manufacturers to guarantee integrity of commercial hardware. I doubt if NASA wants or can accomplish this mission. It would impose an undesirable burden on a government agency to monitor an activity which is the only successful commercial outgrowth of the shuttle program. Our objection to NASA surveillance is that it would increase the cost. Hughes produces hardware for NASA and the Department of Defense which is subject to all the inspection rules and regulations associated with government procurement. Our commercial space hardware is subject to the same high standards. The technology is different. The military and NASA missions involve state-of-the-art engineering which is constantly changing and is a point of continuous negotiations between the government and Hughes. The commercial programs utilize mature technology which is understood at the beginning of the program.

With respect to the government providing insurance capacity, there have been analogies made to other government insurance programs for banks, nuclear plants and flood insurance. These programs arose from catastrophic economic issues or exposures that caused the commercial insurer to totally withdraw from the market. No such circumstance exists with the space programs.

Insurance by the U.S. government would be a subsidy to the satellite communications business. Our competitors in cable and microwave would raise a legitimate complaint. The overseas telephone cables are a case in point. They have been designed, financed and built by the private sector.

The TAT-6 cable to Europe has required significant repairs which meant raising the cable from the ocean floor. The private sector paid the bill.

Financial guarantees by government on space projects could reduce the motivation to supply reliable product. The manufacturers, operators and insurer must work the problem out through the negotiation process. As I stated earlier in my testimony, Hughes has always accepted significant risk on its products. If we need to expand this exposure to assure the continuation of our business, we are prepared to take the risk. We will find ways to see that insurance protection is available to our customers.

SATELLITE INSURANCE HISTORY

[Dollar amounts in millions]

Program	Problem	Loss	
		Date	Amount
OTS	Delta failure	1977	$29
Satcom III	AKM failure	1979	76
ECS	AKM failure	1979	17
Insat 1A	Satellite failure	1982	70
Marecs	Ariane failure	1982	20
Satcom II	Satellite problem	1983	9
Palapa	PAM–D failure	1984	75
Westar	PAM–D failure	1984	105
Intelsat V–F9	Atlas centaur failure	1984	102
Leasat F–3	(1)	1985	85
Leasat F–4 [2]	Satellite failure	1985	84
GTE [2]	Ariane failure	1985	85
ECS [2]	Ariane failure	1985	65
ANIK D–2 [2]	Satellite problem	1985	5
Intelsat V–F6/7 [2]	Satellite problem	1985	10
Total			$837

[1] Spacecraft salvaged and placed in geosynchronous orbit.
[2] Outstanding claims.

Mr. LANGSTAFF. Thank you, Mr. Chairman. I will provide a brief summary.

I think it is important to note a couple of points. First, Space Industries is perhaps the only representative here of a very small company. You spoke in your opening remarks of the need to assess the impact of the problem on new entrepreneurial companies.

Secondly, we are not involved in the communications satellite business, but are trying to commercialize, working with NASA and many others, a new industry based on getting to space to undertake productive activities in space. However, our insurance needs will have to come out of the same pool.

We agree with my professional colleagues here and in NASA that the private sector needs to take the initiative. We think there are two steps that can be taken, and in fact are already being taken, based on our discussions with the insurance industry.

One, the premiums must be set not solely based on statistical analysis, but with more due diligence done on the products that are being insured. If the insurance companies assume this responsibility, either build in-house the capability to analyze the products or turn to the private sector for consultants who can play this role, premiums can be set in a manner which is based on solid technical judgments. Of course, some of this is being done. It needs to be done more.

I think Mr. Barrett is exactly right in that the premiums must be set in such a fashion for the insurance industry to make a profit. If they can make a profit, and can expect to make a profit in the future, insurance capacity will follow.

Space Industries is very interested in this subject because we are designing and building a "first of a kind" asset. Our industrial space facility is not a communications satellite. We are trying very hard to keep our costs low so that it is accessible to the budding commercial industry of users. It is a facility designed to be repaired and serviced in orbit by the shuttle. It is key to us to differentiate our product and make sure the insurance industry understands our product so that fair rates can be set.

However, there may be a lag prior to adequate capacity being provided by the insurance industry. And here I think Mr. Simonoff outlined a number of points that we would concur with, which I will not repeat in detail. It is in the testimony.

But the key guidelines ought to be for a Government role that is temporary, that does not compete with the private sector, that does not add a bureaucratic regulatory authority, and which is self-ending. I think a program that adds capacity, but that does so at higher rates than the private sector, is one that would be self-ending as the private sector capacity fills in.

There is no question that availability of insurance is critical to entrepreneurial companies. We cannot self-insure. Some of the larger companies can. We will take as much risk as we can, but we must pass it on to our sources of capital. It simply increases the costs to us of raising money.

Yes, sir?

[The statement follows:]

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STATEMENT OF DAVID H. LANGSTAFF, SENIOR VICE PRESIDENT & CHIEF FINANCIAL OFFICER, SPACE INDUSTRIES, INC.

My name is David H. Langstaff. I serve as Senior Vice President and Chief Financial Officer for Space Industries, Inc., and am responsible for various financial and business activities of our company. I am honored to be here on behalf of Space Industries, and to share with you our thoughts on the issue of insurance capacity and its impact on commercial space activities.

Space Industries is a three year old company based in Houston, Texas. Led by Dr. Max Faget, we intend to launch and operate, in the 1989/1990 timeframe, the first industrial facility in space, to support research and development, materials processing and other activities in space.

In order to be commercially viable, we must reduce the costs to users of accessing space in our facility. To this end, we have focused on two key cost determinants: first, the building and operating costs associated with our facility and second, the costs of space transportation. We have designed the Industrial Space Facility in such a fashion as to be modular in growth, thereby allowing for economies of operation; to incorporate as much existing technology as possible, thereby decreasing both new development risks as well as costs; and finally, to utilize basic commercial manufacturing and assembly techniques, again reducing costs. In the area of space transportation, NASA has agreed to launch our facility on a deferred payment basis. The net result of these steps will be to decrease the costs associated with the Industrial Space Facility, thereby making it more accessible for commercial use.

A third area that will have significant impact on cost and essentially, the commercial viability of our project is insurance. Consequently, I appreciate the fact that Congress is taking the time to address this issue, and is providing us with an opportunity to share our observations.

Our thoughts can be summarized in two points.

1. The private sector must take the lead in addressing the problems.
2. There is a temporary role for the government that should be considered.

1. PRIVATE SECTOR INITIATIVES

The insurance industry has lost a considerable amount of money on satellite launches. This problem is not one for the government to solve. In fact, a consensus of opinion within the industry (with which we concur) is that this problem is one for the industry participants to solve. They are taking steps to do so.

In our opinion, the brokers and underwriters must undertake a greater degree of technical due diligence. Insurance rates should be driven primarily by a technical understanding of the product being insured rather than by statistical analysis. Technical risk of products should be categorized by independent experts, much as financial risks associated with securities are categorized by independent rating agencies. Then, insurance rates could be set accordingly. With this approach, manufacturers would become more accountable for product performance.

Manufacturers have a responsibility to exercise an appropriate degree of quality control and to educate the insurance industry as to the technical risks associated with its products. At Space Industries, we have an interesting challenge facing us. We are creating a "first-of-a-kind" piece of hardware for which there are no performance records. However, our approach is to maximize the utilization of existing technology, components and hardware. We recognize that in order to obtain insurance at acceptable rates, we need to educate the brokers and underwriters about the technical characteristics of our product so that they can accurately assess risk. All manufacturers of space hardware must assume a similar responsibility.

In short, high insurance rates are the manifestation of inadequate approaches to new hardware by insurers and manufacturers alike. That is the real problem. Insurance rates reflect perceived risk. It is in the interest of both manufacturers and insurance industry participants to better understand the products being insured. Then products can be differentiated and judgments as to risk can be made based on sound technical, not simply statistical, input. If risk assessments can be made more accurately, then rates can be set with greater confidence, and adequate (and increasing) capacity will follow. Furthermore, manufacturers will be compelled to improve reliability on a cost effective basis.

2. GOVERNMENT INITIATIVES

Extending the arguments just presented, the government, being responsible for the design, development, manufacture and operation of the Shuttle, should be held accountable for Shuttle performance. Fortunately, the Shuttle's excellent record has

established a high comfort level within the insurance industry. However, in the event that the Shuttle were to fail to perform its tasks, the government, like any manufacturer/operator, should consider self-insuring or taking other appropriate steps in order to maintain the Shuttle as a competitive launch alternative in the eyes of its customers. NASA already has recognized this responsibility in announcing its new reflight program.

However, the government should consider a broader role that more directly addresses the issue of insurance capacity. On a temporay basis, to bridge the nascent period of the commercial space industry, the government, working with the private sector, could simply add capacity. Such a program might work as follows: Private sector must provide at least 20% of the required insurance, thereby setting a market rate; government would undertake an independent audit of an appraisal (provided by the private sector) of the technical risks associated with the payload/launch; and government would then provide the remaining insurance, at a slight premium to the private sector rate, based on the risk rating.

This approach is simple and straightforward. It keeps the government out of the business of assessing risk or setting rates. The government does not compete with the private sector, but simply augments it. Incentives remain to maximize the amount of insurance placed within the private sector; consequently as the commercial space industry matures the need for government-provided capacity should fall. The program could have a seven-year life but would essentially be self-ending. It could be profitably administered by an organization such as OPIC. It would not represent a subsidy.

Why should the government play this role? Both the President and both houses of Congress have endorsed the commercialization of space. With the Shuttle and Space Station programs, the continued development, exploration and profitable application of knowledge gained from space have been established as national priorities. Over the last 25 years, our investment in space has paid handsome dividends in the form of technological advances; creation of new products and industries and consequently, increased tax revenues; maintenance of U.S. technological leadership; and, perhaps most importantly, continuation of a strong sense of patriotic accomplishment. There is no reason to believe that, with continued investment, these benefits will not continue to accure.

What is at stake, then, by a lack of adequate insurance capacity? In the extreme, if there is no insurance, manufacturers and operators will be forced to bear the risk themselves. The result will be at best, a dramatic increase in the costs of the products/services to the customer, or at worst, no business at all. Such scenarios would represent significant barriers to space commercialization since only large financially well-capitalized companies could afford to participate. Project financing would be eliminated. New innovative and entrepreneurial companies like Space Industries would simply not exist. Without insurance, the compounding of risk and consequent cost of capital would make most commercial space ventures uneconomic. How is this situation in the country's interest in light of the actual and planned investment in the Space Shuttle and Space Station? If the government desires or expects private sector participation in the development of space, adequate insurance capacity simply must be available.

In summary, the shared objective of all concerned is as follows: Ensure that adequate insurance is available so that the commercial development of space continues, increase technical due diligence so that accurate risk assessments can be made, and avoid establishing a system that is dependent upon long-term or extensive government participation.

The temporary role for government proposed here helps ensure private sector participation in meeting established national objectives. It can be implemented profitably in a manner which avoids the creation of a regulatory authority, avoids competition with the private sector and yet, directly addresses the problem. Taken with the proposed initiatives by the private sector, the question of insurance availability will not be the bottleneck to space commercialization and the existence of adequate insurance capacity will be guaranteed.

Thank you.

Senator GORTON. How would your project be affected if you were looking for insurance right now today, at the present?

Mr. LANGSTAFF. I do not think we could get insurance right now.

Senator GORTON. Does that mean you could not—

Mr. LANGSTAFF. First of all, we have—I am sorry?

Senator GORTON. Does that mean you could not go ahead with your project?

Mr. LANGSTAFF. Right now our investors are taking as part of the risk an assumption of the fact that we will be able to get insurance. We will not need it for about two years, but we intend throughout the final design and development stage and certainly the manufacturing stage of our project to involve the underwriters directly to see what we are doing.

Senator GORTON. You want to create a category of your own?

Mr. LANGSTAFF. I am sorry?

Senator GORTON. You are going to have to create an underwriting category of your own?

Mr. LANGSTAFF. We are going to—that is correct, we are going to have to involve in the space insurance business players from the underwriting community that have not currently underwritten space ventures. Although our industrial space facility might be a category of its own, insurance for it must come from the same, limited pool that exists for other space hardware. We need to increase the size of the pool.

Senator GORTON. So the condition of the space insurance market is literally a life and death question to your project and to other companies which are similar to yours, is that correct?

Mr. LANGSTAFF. Yes, sir, I think that is a fair statement.

There is already substantial risk that our investors—and we as a private company—face in simply undertaking the kind of project we have focused on—and this is not particular to us, but anyone trying to do materials processing in space. Right now there is no commercial materials processing market. It is in the development stage. It needs infrastructure, it needs support, it needs to be helped.

You have recognized in your opening statement the fact that there is a tremendous amount of public good in this activity being realized sucessfully. The country, the President, bipartisan Congressional support have all recognized this by investing in the space shuttle and in establishing the space Station as a national goal.

It will not happen unless there is adequate insurance, and it would seem to me unfortunate if the entrepreneurial and small innovative companies are cut out simply because they cannot self-insure.

That concludes my remarks.

Senator GORTON. Dr. Wheelon, I understand Leasat V's deployment has been delayed. Has the insurance question played a role in that decision?

Dr. WHEELON. It has not. We intentionally delayed the planned launch from December until September of next year, primarily so that we could assure ourselves that we both understood and had corrected

whatever problems befell Leasat IV. We will go forward in any case under the assumption we will have to self-insure.

Senator GORTON. Well, you state in your written testimony that you do not believe it to be in the best interests of the Government to intervene in the current insurance predicament. Under what circumstances would Government intervention be appropriate? 30 to 35 percent rates, the ability to insure only up to 40 percent of payload value, whatever? Dr. Waylan, go ahead.

Dr. WAYLAN. My view would be that it would be dangerous and certainly not well advised to try to attach that amount of significance to one parameter, such as rate. So I am not prepared to say that there is a magic rate under which one would make the decisions, and certainly I believe that it is imperative that we would wait and reconsider that at the time, not currently.

Dr. WHEELON. My answer to that question is that it is highly unlikely that you will see rates like that. We would not be meeting here today if the underwriters had charged 14 percent, which is the actual loss rate, as opposed to 7 percent.

They have an understandable incentive to try to recoup their losses because of this underbidding. But others will enter the field who do not carry that burden, and I think the market will equalizbrate at a rate between 10 and 20 percent. And so I do not foresee a time when the rates will be 30 percent. Others will simply come in and fill the market at the proper rate.

Senator GORTON. Thank you.

We may have a handful of additional questions. Other members may have some questions, which we will submit to you in writing.

But I want to thank you not only for your testimony this morning, but for your patience as well.

With that, the meeting is adjourned.

[Whereupon, at 12:20 p.m., the subcommittee was adjourned.

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STATEMENT OF ROBERT J. TIRONE, VICE PRESIDENT, AVIATION & AEROSPACE DIVISION

On behalf of Alexander & Alexander Inc., I would like to thank the committee and its chairman for this opportunity to submit for the record, a statement on Insurance Capacity and its impact on commercial space activities.

We will address all of the questions raised by the committee in its invitation to comment, with particular emphasis on what role, if any, there is for government intervention in the absence of adequate satellite insurance capacity.

Our statement today deals with the topic of space—the new frontier of modern man. My comments must begin, however, in earlier times.

Records dating back to the ancient Phoenician traders testify to the existence and reliance on insurance. Early Greek and Egyptians records demonstrate the application of "bottomry" contracts or bonds. This early method of risk sharing evolved quickly into the more modern use of Insurance. As early as 1435, the magistrates, in Barcelona established rules governing Marine Insurance. While we do not know if Christopher Columbus took advantage of the insurance mechanism, we do know for certain there was a functioning and thriving insurance market.

The fact is, that insurance is an important component of commerce and industry. It is not an understatement to say that insurance is a lubricant for the wheels of industry.

The magistrates in Barcelona initiated government involvement in insurance in a way that has continued until today. Certainly in the United States at this time government's role is one of regulatory and not participant in the insurance industry. There have been times in our commercial history when the federal government has deemed it necessary to intercede in the insurance industry by providing coverage that was not commercially available. An example, would be the U.S. Government War Risk insurance program that provided War Risk coverages to airlines, allowing international trade by air to continue. We do not believe that the present condition of the Space Insurance market requires such a direct involvement by the government at this time. However, we do see an increased role for the government in support of the existing Space Insurance market.

Insurance is a necessity. A particular necessity in the Aerospace industry. I don't think anyone doubts that insurance has played a major role in expanding the willingness of industry to accept a role in the commercialization of space.

We are at a very critical time, however. As I have just stated, insurance has been an active and willing participant in the commercialization of space. However, because of the tremendous underwriting losses that have occurred, particularly within the past two years, there is a grave risk that the insurance industry may abandon its participation in the space effort.

Through various sources, I am certain that you are already aware of the grim loss statistics. There is an attachment furnished herewith which recites those statistics. The record is bleak. Since 1965, the space underwriters have suffered a net loss of close to $500,000,000.

Like any business, the insurance market expects a fair return on investment and effort. Unlike other businesses, however, insurers cannot precisely determine their product cost until after their product has been distributed and sold. The insurance claim can only be made after the insurance policy has been delivered and the premium level agreed upon and paid. This aspect of the insurance business is well recognized and can usually be dealt with easily. The anticipated casualty rate of exposure units can be actuarially studied. Basic actuarial analysis can easily calculate a proper rating basis. In fact, the more individual exposure units studied, the simpler the task.

Unfortunately, the insurers are unable to use actuaries in their rate-making effort for space insurance. There are simply not enough exposure units to make a sound prediction. During 1985 and for the forseeable future, no more than 25 to 30 satellites will be launched in any given year. Predicting how many of the scheduled satellites will fail is impossible. Actuarial analysis also requires the study of homogeneous exposure units. The significant variation in satellite design makes such study impractical.

An alternative method of rate-making is an "educated" estimate of casualty rates heavily dependent upon product confidence. Insurers have successfully underwritten one-of-a-kind exposure units based on such confidence in a product or industry. The Insurers' trust in an positive response to the wide-bodied jet aircraft introduced in the late 1960's shows their willingness to assume "massive exposures" resulting from new technology. In this case the market trusted that the technology was sound. Trust is the primary underwriting ingredient used in evaluating space busi-

ness. If Insurers believe that the technology is sound and the manufacturing process is proper, they have been willing to accept risks.

That confidence and trust in the product no longer exist today.

Underwriters cannot predict with any certainty, either actuarially or through reliance on the technology, which satellites they should insure, if any.

Until this confidence can be restored, insurers will continue to react negatively toward space insurance offerings.

Already, today, we are seeing this negative market reaction:

Premium costs have escalated tremendously in the last two years. Average launch insurance rates today are approximately 20%.

Some underwriters have severely restricted the amount of insurance they will place on any given offering—a restriction in capacity.

All underwriters have severely restricted the scope of the coverage that they will offer to prospective satellite owners.

Underwriters will not commit to insurance programs until 90 days prior to launch. This is not sufficient time to arrange for proper financing and business planning.

Many underwriters have withdrawn completely from the market.

Working with our clients, we have easily verified an insurable interest of $100 or $150 million on a single satellite. Recognize that this insured satellite can be placed on a Shuttle mission in the company of perhaps two other satellites equivalently valued. Recognize also that the most generous guess in today's insurance marketplace is that there is at most only $75 million total capacity available to insure this potential $450 million mission.

Continued deterioration, or even a leveling of the Space Insurance market at todays level of capacity will create significant problems for the continued commercialization of space. As already shown, present capacity is inadequate to cover even a single communications satellite. Larger and more expensive payloads such as short or long duration platforms, MPS platforms and, of course any space station would (at today's level) be so under-insured as to effectively be uninsured or self insured. Few, if any, corporations, alone or as a joint venturee, would be in a position to commit the corporate assets necessary to develop such programs without the reasonable expectation of being able to insure the on-orbit asset. They would find more secure areas for commercial development and investment.

Absent the ability to properly insure space projects, due to either a lack of capacity or unrealistic rates, the commercial development of space, so important to the U.S., will be severely hindered. We cannot allow that to happen.

Something must be done.

A review of the causes of the losses suffered by the space insurers does not provide a single answer to the problem. There is no single, identifiable weak link in the chain that, once strengthened, would put the industry back on sound footing. Only unprecedented cooperation between insurers, insureds, owner/operators, manufacturers, the financial community, launch agencies and the regulatory government authorities can provide a solution. The private sector must work together and fully explore, inter alia: Proper valuation methods for on-orbit assets; proper levels of self-funding (insuring) vis-a-vis commercial insurance levels; use of industry captives; joint buying of insurance or other methods of risk sharing; enhanced quality control and assurance programs; reasonable and proper terms of coverage expected from the insurance industry.

We believe that the government does have a role to play and that it is time for the government to act.

We firmly believe in a free market, and do not recommend any direct or indirect government participation in the business of insurance. Since the very earliest days, the insurance industry freely participated with the space pioneers. They did this because they believed in the technology and they believed there was an opportunity for profit. We believe that the government's role should be to assist in restoring that trust and confidence.

We recommend the following actions be taken:

(1) NASA should take steps to totally indemnify satellite owners for direct damage (from whatever source) to satellites while in the custody of NASA, i.e. from acceptance of satellite on the ground of Cape Canaveral to release from the Shuttle in low Earth orbit. NASA already assumes full responsibility for the multi-billion dollar orbiter and the lives aboard. NASA acts as a bailee in their accepting custody of satellites. We ask that they face up to and accept this responsibility.

(2) NASA needs to set qualitative standards for design and manufacture of upper stage propulsion systems and satellites. It needs to perform qualitative inspections of such upper stages and satellites prior to acceptance for launch.

(Precedent: Federal Aviation Administration imposed standards & inspection in the aircraft industry.)

(3) In the event of a satellite failure, NASA should act as fact finder in determining cause of loss.

(Precedent: National Transportation Safety Board is responsible for conducting accident investigations.)

NASA's integrity and results record, especially in respect to the Space Transportation System, are impeccable. The trust and confidence inspired by such a record must be transferred to the payloads carried aboard the Shuttle.

This new trust in the integrity of the upper stages and the satellites will lure underwriters back into the marketplace, with correspondingly lower and more reasonable premium levels.

The resulting revitalized insurance industry will look favorably upon NASA's increased involvement. The industry will benefit from NASA's actions and thereby enhance the overall effort of all parties toward the Commercialization of Space.

We also see a significant side benefit to NASA: NASA launched payloads will ultimately receive a preferential premium treatment by insurance underwriters thereby aiding NASA's efforts to attract customers.

We think this is a realistic and proper role for the Government (via NASA) to take. There are various other motivators as to why our nation needs a strong effort toward the commercialization of space. Such other political, economic and military considerations are beyond the expertise of myself or my organization. We do firmly recognize, however, that they exist.

We further believe that our recommendations are fitting and proper in defining the proper role of government.

We do not need government to help the insurance industry define a proper rating base for automobile insurance exposure units. We do, however, need government to employ traffic patrolmen and to set realistic and safe traffic standards.

We do not need government to help us in setting rates or finding adequate capacity to insure office buildings and dwellings, we do need government to establish proper Building Codes and to provide Fire Departments.

We believe our recommendations can be easily implemented—at no cost to the taxpayer. In fact, as we have stated, we believe that such action will enhance this nation's ability to attract customers from the international community and encourage them to utilize the Space Transportation System.

We believe our recommendations will ultimately benefit all parties; satellites owners, manufacturers, insurers, and government. The ultimate benefactors will be the space industry and the public at large.

LAUNCH ATTEMPT FAILURE HISTORY 1970 TO PRESENT

[Dollar amounts in millions]

Date	Spacecraft	Launch vehicle	Loss cause	Insured value
09/12/85	Spacenet III	Ariane 3-L15	LV 3rd stage failure	$85
09/12/85	Eutelsat ECS-3	Ariane 3-L15	LV 3rd stage failure	65
08/29/85	Leasat 4	STS 51-I	S/C UHF antenna failed	85
04/12/85	Leasat 3	STS 51-D	S/C upper stage, non-start	[1] 85
02/08/85	Arabsat 1A	Ariane 3	S/C attitude control (Gyros)	25
11/08/84 [2]	Anik D-2	STS 51-A	S/C Spin-up/fuel loss	4
06/09/84	Intelsat V F-9	Atlas cent	LV 3rd stage	102
02/06/84	Palapa B-2	STS 41-B	PAM-D exit cone	[1] 75
02/03/84	Westar VI	STS 41-B	PAM-B exit cone	[1] 106
01/23/84 [2]	BS-2A (Japan)	N-2 (Japan)	S/C, 2 of 3 xpndrs failed	
06/16/83	Amsat oscar 10	Ariane 1-L6	LV 3rd stage bumped S/C	
04/04/83 [3]	TDRS-A	STS 31-B	I.U.S. malfunction	
09/10/82	ESA Marecs-B	Ariane 1-L5	LV 3rd stage turbopump	20
09/10/82	SIRIO 2	Ariane 1-L5	LV 3rd stage turbopump	
04/10/82	INSAT 1A	Delta 3910/PAM	S/C deployment problems	65
06/19/81	Meteosat 2	Ariane 1-L3	S/C malfunctions	
02/22/80	Ayame ECS-2	N-1 (Japan)	S/C AKM malfunction	
12/07/79	Satcom III	Delta 3914	S/C AKM exist cone	77
02/06/79	Ayame ECS-1	N-1	LV 3rd stage hit SA/C	15
09/29/77	Intelsat 4A F-5	Atlas cent	LV destroyed	
09/13/77	OTS-1	Delta 2914	LV 1st stage exploded	34

LAUNCH ATTEMPT FAILURE HISTORY 1970 TO PRESENT—Continued

[Dollar amounts in millions]

Date	Spacecraft	Launch vehicle	Loss cause	Insured value
04/20/77	Geos	Delta 2914	LV 2nd stage spin-up	
02/20/75	Intelsat IV F-6	Atlas cent	LV failure	
07/23/70	Intelsat 3 F-8	Delta	S/C AKM failure	
		Other Known Losses		
06/01/83	Satcom II	N/A	12 xpndrs failed after E.O.D.L	9
Various miscellaneous (incentives, penalties, etc.) claims				48
Cumulative insured losses (est.).				900

[1] Figures do not include expenditures for recovery and/or refurbishment.
[2] Failures not related to launch attempt per se, but would have been losses under launch policies.
[3] S/C saved by extra fuel.

Satellite Insurance: Alternatives for the Public and Private Sectors

I. Introduction

Satellite insurance may or may not be in trouble—depending, of course, on who you first talk to.

James Barrett, president of International Technology Underwriters (Intec), says that "the current shortfall in the availability of insurance is simply a reflection of the normal market functioning." Vice President Robert Tirone of Alexander & Alexander, meanwhile, contents "there is a grave risk that the insurance industry man abandon its participation in the space effort."

The commercial satellite insurance industry has lost over $600 million in the last 21 months due to satellite failures. Stephen R. Merrett, chairman of Merrett Syndicates, Ltd. of London, described the satellite underwriter's situation to *Aviation Week & Space Technology* this way: "Many are going to wait and see what proposals are made, then evaluate and respond."

Underwriters are thus looking for better methods of insuring satellities than the method currently used. Most want the overall structure to remain the same, but alterations to that system probably will be made to stop the recent hemorrhaging of losses.

Whether those changes come from private or governmental circles is the focus of this report.

II. Alternatives Available to the Private Sector in Remedying the Satellite Insurance Program

A. SELF-INSURANCE

1. The manufacturer as sole insurer

Satellites manufactured today are indeed expensive. The average communications satellite today costs from $80–120 million to build and launch. This total, of course, does not calcuate the added costs of ground support hardware and staff which brings a satellite investment for a user to $200 million or higher.

If a satellite manufacturer insured his $100 million satellite with in-house funds and the satellite was subsequently lost, this would create a $40–50 million after-tax loss to a satellite manufacturer. If such an unfortunate failure occurred, a visible financial impact on that satellite manufacturer's quarterly earnings would result.

Assume for example, that Hughes Aircraft individually assumes the entire risk on its Leasat 5 satellite. The company would then be gambling with a potential $40–50 million loss after taxes. Such a risk would directly impact Hughes' parent company, GM, in the form of lower earnings if such a loss occurred.

If the Leasat 5 was launched during GM's third quarter last year and was lost, GM's earnings for that third quarter would decrease from 20.2% to 8.2%, according to Jerome Simonoff, an investment banker for Citicorp. "Smaller" companies such as RCA would take an even harder blow. RCA's third quarter profit of $50 million, for example, would be erased if it had covered a $100 million satellite loss.

Self-insurance by an individual company is not a novel idea. Satellite Business Systems (SBS), for example, was unable to obtain enough insurance on its SBS-D satellite and had to risk between $5–$10 million of its own assets when the satellite was launched aboard the Shuttle in August 1984.

Shareholders enjoy profits. Failure to maximize these profits by a company's board of directors often results in a rash of stockholder derivative suits against a company's board of directors.

Court decisions in shareholder derivative suits traditionally shielded a board of directors from shareholder suits by holding that a board's decision, if shown to be made with good "business judgment," cannot be challenged.

But the Delaware Supreme Court in *Smith* v. *Van Gorkom* recently held that the business judgment rule protecting decisions made by a company's board of directors might be challenged when a corporation's board or management does not act in an "informed" manner.

This decision may open the door to later suits which challenge the "fairness" of corporate decisions. Hence, a satellite manufacturer's decision to insure its own satellites might be grounds for a successful derivative suit which alleges that such a decision was not "informed" in the face of the industry's past track record and degree of financial exposure that decision created for the company.

2. Self-insurance pools

Satellite manufacturers have also discussed the possibilities of a self-insurance pool, using letters of credit between manufacturers and users to establish a new insurance entity.

Satellite owners met earlier this year to discuss the formation of the "Spacecraft Owners' Council". This insurance pool, proposed by the satellite insurance broker Corroon and Black/Inspace, would use letters of credit for satellite manufacturers to take an equal share of the risk in the coverage of a specified number of satellites over a selected period of time.

This pooling arrangement would cover the loss of one satellite with a provision that future losses would be covered by an insurance policy paid by the manufacturer consortium to protect against a second or third satellite loss.

While self-insurance appears likely for groups such as bankers, doctors, or lawyers, satellite self-insurance suffers from many unique problems which could prevent the idea from ever coming to fruition.

First, satellite self-insurance, unlike a similar program for bankers and doctors, cannot spread the risk adequately. There are a handful of major satellite manufacturers while there are 12,000 banks in the American Bankers Association.

Second, the risks to each satellite manufacturer would be hard to allocate evenly. The satellite manufacturer who launches the first satellite has greater protection than the manufacturer who launches last.

Third, different specifications and levels of complexity with each satellite means that satellite manufacturer who produce of the shelf technology satellites suffer a higher risk when pooled with manufacturers who produce state of the art spacecraft.

Finally, a manufacturer insurance pool will need to police its members in making sure quality assurance and management control are maintained. This could create conflicts of interest between manufacturers who are not happy in sharing technologies with competitors.

3. Tax implications of satellite self-insurance

The traditional position of the Internal Revenue Service has been to refuse a deduction for self-insurance reserves of non-insurance companies until the claim is actually paid or settled. The regulation underlying that position contains what is commonly referred to as the "All Events Test."

The test for the deductibility of an expense by an accrual method taxpayer requires that: (1) a liability has in fact occurred; and (2) the amount of the liability can be determined with reasonable accuracy.

In order to fit within the rule for accrued expense deductibility of self-insurance reserves, satellite businesses could possibly benefit from a new government requirement that they maintain certain reserves for contingent losses. A statutory reserve requirement would create a government-imposed liability that could be construed as passing the first part of the "All Events Test".

Based on expert estimates of the satellite failure risks during a given tax year, the taxpayer's cost of such a loss could be accrued during the launch year. Or, if the satellite is the subject of a contract for a term of years, part of the cost of the satellite could be deducted during the launch year and each of the years of the contract according to the latest expert risk analysis.

As the satellite industry becomes healthier, the risk of loss will decrease, statutory reserve requirements may be adjusted downward, and accrued expense deductions may follow.

The second prong of the "All Events Test", requiring that the amount of a fixed liability be determined with reasonable accuracy, may be satisfied through the use of procedures that have been found sufficiently reliable in other industries. The estimates of liability must be made by experienced individuals who have a professional awareness of the risk factors involved in space business. These estimates must be based on facts known at the end of the tax year—i.e., that a satellite was launched and/or that it is experiencing difficulty.

B. UNDERWRITERS AND BROKERS ACTING AS BETTER WATCHDOGS OF A SATELLITE MANUFACTURER'S ACTIVITIES

Another proposal exists that the current insurance system will operate fine as it is structured today so long as the underwriters and brokers assume more responsibility in monitoring the satellite manufacturer's management and quality control standards more closely.

Eagle Engineering, an aerospace consulting firm based in Houston, Texas and contributor to the technical issues of this report, has been in recent contact with several leading U.S. brokers and underwriters involved in space satellite insurance coverage about this proposal.

Eagle suggests that satellite insurers and manufacturers can reduce their risk by jointly employing an engineering management system now in force at NASA.

1. Eagle Engineering's proposal

If one examines the failures in recent space satellite programs, an experienced observer will note that no single engineering discipline is the predominant cause of satellite failures. Losses have been caused by computer and mechanical switch problems, electrical and electronic component malfunctions, difficulties with propulsion systems and, in some cases, process and procedure errors. No one company or team of companies has been the single source of failures. Competent, experienced companies with outstanding records have been hit.

Therefore, one possible conclusion is that a total "system breakdown" has occurred and one must look beyond the simplistic "mechanisms of failures" cited in the literature and search for the true causes of these failures.

Many "causes" of these failures are classified under the general term of "poor quality control". Blame has been placed on errors in inspection and testings as the "cause of failure".

Yet seldom does an investigator see that the failure investigated is just a part of an entire procedure or process which as a whole did not not address a particular inspection or test.

In other words, no "end-to-end" review of the total system flow is made. Steps such as inspections and tests are but tools of a quality control program which in turn is only one of several tools that the engineering program manager must use in a successful project.

Thus, when a rash of problems are occurring in a program such as satellite manufacturing the problem is not a state-of-the-art deficiency. Instead, it may well be that the engineering manager may be failing to use all of the tools he has available to correct a faulty review system that does not integrate all of the elements necessary for a successful satellite launch.

Eagle Engineering, a collection of 60 former NASA engineers who were instrumental in the development of the Apollo and Shuttle programs, believes that the engineering management method developed by NASA and its contractors to deal with complex spacecraft would be very useful in improving the success rate of satellite launches. It is a system that has proven to be very reliable under extremely adverse conditions.

This system calls for an adversarial relationship during the review process between the satellite manufacturer and the insurance company. Underwriters need to assume the role of Devil's Advocate to help find problems in the manufacturing process.

The manufacturer has the talent and competency to design and develop a satellite. But challenging the steps used in the development of the satellite construction, underwriters and brokers represent intelligent, constructive outside reviewers whose only motivation is to contribute to the success of the project.

Between the two groups, each subsystem would be checked, reviewed, checked again, and when the system was released, the configuration would be strictly controlled to prevent changes. An adversarial approach which challenges a manufac-

turer would prove invaluable in developing rigor and discipline in the manufacturer that leads to the most careful workmanship and engineering diligence possible.

NASA used this adversarial review system with its contractors in the Apollo and Shuttle programs. A typical "Spacecraft Design/Development Review Cycle" is shown in Figure 1 with a time-phasing of these review steps illustrated in Figure 2.

NASA's experience with this adversarial review technique started slow and was often marred by arguments between Government and contractor personnel over the right way to do things. But as these teams continued to work together, a friendly adversarial role eventually developed which did not compromise any independent review by both engineer teams.

Eagle maintains that reviews of this type with controls over the spacecraft configuration represent the correct approach to improve reliability and success rates in the satellite industry. They believe that many of the satellite developers already use similar review cycles, but that underwriters need to increase their visibility in the development of the hardware and the overall satellite program. The integration of these two parties in a structured review cycle can accommodate the needs of the industry.

For a complete NASA-type review, the outside underwriter and broker reviewers must have access to detailed design data and test results on products such as schematics, functional specifications and qualification results. Concerns over proprietary rights or improper disclosure of data to competitors can be serious stumbling blocks if written agreements between parties are not developed or if mutual trust does not exist.

What can be done by the insurance underwriter is to monitor key plans such as those listed in Figure 3 and to assure that a schedule for the satellite proving conformance to these plans is followed and a responsible management review cycle is created to examine the completion and acceptability of the results.

Eagle believes that a review system could be established where only important categories or classes of changes are earmarked for review. Eagle maintains a simplified audit or review system can be developed which will provide the underwriters with sufficient insight into the risks which allows realistic premiums to be set while not endangering their future. Adversarial aspects of the review can be incorporated as long as the boundaries of the review and the rules of the review are defined and mutually agreed upon before the cycle begins.

Such a system, however, must be exercised and implemented by an experienced technical staff. The question as to whether this staff is a governmental agency or a private consulting company must be answered.

2. Government advisors as watchdogs

NASA has the technical capability to perform such a function. But the agency would have difficulty in controlling the scope of such reviews. Maintaining the privacy of design details or company procedures with NASA would also be a difficult task.

3. Private consultants as watchdogs

There are a number of qualified, competent private organizations capable of advising or monitoring the space satellite development activities for the underwriter to choose as well. Any disclosure limitations required by the satellite developer can be enforced directly by contract, thus achieving close control over documents.

C. DEDUCTIBLE PROVISIONS REINSTITUTED IN SATELLITE INSURANCE PROVISIONS

Manufacturer accountability today is largely maintained by incentive contracts and fines which provide the manufacturer with bonuses or penalties from the user for various successes or failures in the construction and launch phases of a satellite. These bonuses and fines are arranged by contract between the manufacturer and buyer of a satellite. Whether deductible responsibility is a better method of manufacturer accountability is fertile ground for future study.

III. Governmental Actions

Federal and state government promotion and support of fledging industries is as old as this country, despite our supposed overriding policy of laissez-faire economics. From the beginning, state governments financed major internal improvements such as highways, canals and railroads in order to facilitate commerce and industry.

Governmental involvement in space could take the form of subsidization similar to support offered to the canal, railroad, and highway industries.

Favorable federal and state tax treatment, discussed below, could also be pursued as a way to encourage the satellite industry.

A. CREATION OF AN INVESTMENT TAX CREDIT TO FUND A SATELLITE INSURANCE PROGRAM

The addition of the investment credit to the Federal tax law is a governmental response to the preceived social and economic need for incentives to promote and facilitate industrial expansion and modernization of plant and equipment in the United States.

The investment credit "incentive" encourages the private sector to participate in the economic expansion of the United States which otherwise would have been funded by direct government expenditure. Private sector participation is on every conceivable front of the economy. The governmental bureaucracy necessary to accomplish many of the results using other approaches besides tax credits would have been enormous and complex. The avoidance of governmental bureaucracy with tax credits eliminated many of the political realities of policy making.

The private sector's entry into the cost and risk of space commercialization has created the need for additional incentives in order to maintain the objectives of the United States in the commercialization of space.

Potential market failure of satellite insurance could be corrected by the creation of a governmental or quasi-governmental "non-profit" insurance program funded by the private sector to provide insurance coverage for the prelaunch, launch, and in-orbit operation of commercial communication satellites. As an incentive for investors to provide sufficient funds in operating a satellite insurance loss reserve, a new tax credit could be created. In order to prohibit any potential windfall to the investor, the program would be "non-profit". Hence there would be no direct dividend payment to an investor. Instead, the reserves would be invested in non-interest bearing government bonds. The government would have free use of this bond money and any accumulated surplus to fund the further development of technology for the utilization and/or commercialization of space. The investor in turn would be using the tax credit system to help significantly lower his or her taxes.

The program's effect on the overall tax base could be minimized by appropriate limitations similar to those of other existing tax credits and/or limitations on the size of the reserve to be established.

B. LAST RESORT INSURER

One proposal advocated by Jerome Simonoff of Citicorp urges the government to act as an insurer of last resort. Here, insurance coverage not available on the open market would be obtained from governmental funds.

Some experts contend that the government's support system is already overextended and not ready to get in another insurance subsidy program. They argue that there are just so many programs the government can feed with its tax money.

The same question will be posed to satellite insurance. Experts such as Simonoff contend that the satellite industry is a viable one and only needs temporary support till the industry can again stand on its financial feet. Such temporary support in the form of government loans has worked in the past with Chrysler, for example. Perhaps, then, a similar scenario would result with the satellite industry after government support in the form of insurance coverage, loans, or tax credits.

C. STOP LOSS INSURER

Another alternative the government could pursue is a stop-loss program for satelliter insurance. The insurance companies would pay for losses up to a certain agreed level and the government would cover the excess losses suffered through loans or direct subsidies.

This procedure is now used in several areas. One such area is the federal flood insurance program. Yet risk spreading in the flood insurance program, for example, is much easier over thousands of homeowners than it is with a few satellite manufacturers.

Furthermore, the government has conducted extensive studies as to the risks faced by insurers of homes in flood-prone areas. No such study has been conducted by the government in the field of satellite risks. Risk assessment is very difficult, if not impossible, for satellite insurance due to the complexity of the endeavor.

IV. Conclusion

The satellite industry will hopefully remain viable regardless of the approach taken by the private sector or government to solve its current problems.

We firmly believe that the satellite manufacturers and insurance companies will prosper and grow in their field and eventually open the door for the space industrial revolution of the 21st Century.

Figure 1—Typical spacecraft design/development review cycle.

Preliminary requirements review [PRR]—Establish engineering "boundaries" and requirements to meet mission.

Systems requirements review [SRR]—Develop subsystem requirements and interfaces. Establish control boards, working groups.

Preliminary design review [PDR—About 10% of drawings completed. Interfaces defined; issues established for tracking and closeout.

Critical design review [CDR]—About 90% of drawings released. Configuration Control, schedule "frozen": discrepancy closeout.

Customer acceptance review [CAR]—Closeout of open issues, customer "buy off".

Cargo integration review [CIR]—Launch vehicle interface check, mission operations, timelines, bay compatibility. etc.

Flight readiness review [FRR]—Certification for flight.

EAGLE ENGINEERING

Typical Time Phasing of Spacecraft Development Cycle

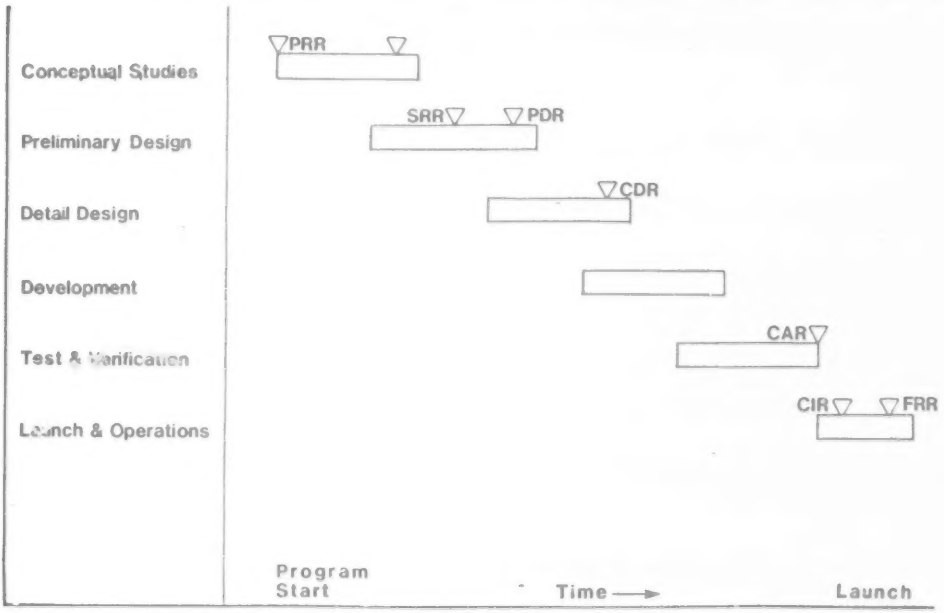


Figure 2

Figure 3—Examples of key plans:
Configuration Control Plan;
Design Certification Review Plan;
Qualification Test Plan;
Failure Modes and Effects Analysis;
SR&QA Program Plan;
Hardware/Software Integration Checkout Plan; and
Problem/Discrepancy Tracking Program Plan.

SPACE

Volume II, Number 11

THE SPACE INSURANCE INDUSTRY

Summary

Space insurance is a prerequisite for the development of commercial space ventures. The stability, and even the future existence, of the space insurance industry has been called into question by the magnitude of recent claims for satellite losses. This issue of SPACE examines the implications of recent losses for commercial space activities in the future.

In the November 1984 issue, SPACE reported that the satellite insurance industry was staggering under the impact of $282 million in losses, and concerned officials from industry and government were searching for solutions. The industry outlook has not improved in the intervening year. Total losses in the past 21 months exceed $600 million. In addition to the three satellites lost in 1984, six satellites have malfunctioned or failed in orbit in 1985: Telesat Canada filed a claim on Anik D-2 in March 1985; Leasat 3's upper stage motor malfunctioned in April after launch from the Shuttle; Leasat 4 was lost in August; and in September Eutelsat's ECS-3 and Spacenet III were destroyed aboard Ariane V15, while Hughes reported that its Leasat 2 lost its only wideband channel. With a loss ratio of approximately 200% (claims paid have been double the amount of premiums received), the continued economic viability of the industry is being questioned.

Government intervention in the space insurance market as an "insurer of last resort" has been opposed by most brokers, underwriters, satellite owners and manufacturers, as well as NASA and the Department of Transportation. In light of this lack of support, and the current budget deficit, government intervention is most unlikely.

Despite recent disasters the industry has not collapsed, and revenue from higher premium rates may even attract additional capacity. Launch insurance premiums on policies issued this year have ranged from 16% to 20% of the sum insured, and recent quotes have been as high as 30%. Many of the satellites insured in series during the early 1980s at rates under 8% have already been launched, and the remainder will be launched shortly. In addition, underwriters will no longer commit to insurance until 90 days prior to launch (previous practice was to offer insurance as much as three years in advance of launch). Accordingly, most satellites launched during the next five years will probably be insured at rates that more nearly approximate actual loss rates.

In the near term, we believe that higher launch insurance rates and limited capacity will have their greatest impact on new satellite operators and launch vehicle manufacturers. New satellite operators have been placed in a "catch 22" situation: insurance is a precondition of financing, yet financing must take place long before the insurance firms are willing to offer coverage. Two launch vehicle manufacturers are subject to risk of nonperformance of their products. The current insurance crisis is not expected to have a major impact on commercial operations in low earth (i.e., Shuttle) orbit. This is because the Shuttle has proven extremely reliable in transporting goods to LEO; the problems (with Shuttle-launched satellites) have resided either in the upper stages used to boost satellites to geosynchronous orbit, or in the satellites themselves.

Introduction

In the November 1984 issue, **SPACE** reported that the satellite insurance industry was staggering under the impact of $282 million in losses, and concerned officials from industry and government were searching for solutions. The industry outlook has not improved in the intervening year. Total losses in the past 21 months exceed $600 million. In addition to the three losses in 1984, six satellites have malfunctioned or been destroyed so far this year: Telesat Canada filed a claim on Anik D-2 in March 1985; Leasat 3's upper stage motor malfunctioned in April after launch from the Shuttle; Leasat 4 was lost in August; and in September Eutelsat's ECS-3 and Spacenet III were destroyed aboard Ariane V15, while Hughes reported that Leasat 2 lost its only wideband channel. Moreover, Indonesia's Palapa B2 and Western Union's Westar VI, which failed to reach geostationary orbit in February 1984 when their PAM-D upper stages malfunctioned, remain unsold despite their dramatic retrieval in November 1984. With a loss ratio of approximately 200%, the continued economic viability of the industry is being questioned.

Several programs have been withdrawn from the market, and more may be dropped when reinsurance treaties are renewed in 1986. Some London underwriters withdrew all outstanding quotations in early September and Intec, the leading U.S. underwriter, has stated that it will no longer provide coverage for a satellite's performance until it is on station and operating correctly.

Although rumors of the imminent demise of the space insurance industry have been exaggerated, the problems are real and cannot be discounted. The industry has suffered enormous losses and has not been profitable for several years. Capacity has sharply declined from the 1983 high, and the magnitude of the recent losses raises the disturbing possibility that the availability of space insurance will decline further at precisely the time when increased coverage is needed to assist evolving commercial space ventures in low earth orbit, as well as to support the satellite telecommunications industry.

Rates have rise sharply in recent months, which suggests that new capacity may be attracted. Nevertheless, many speculate that another loss this year might kill the industry before higher rates could attract new underwriters and reestablish a positive premium base. Some brokers and underwriters predict that another loss (on any type of vehicle) could push launch insurance rates as high as 40%. Premium rates at that level would almost certainly force potential customers to seek alternatives to market insurance or to cancel launch plans entirely.

However, despite the recent disasters, the industry has not collapsed and revenue from higher premium rates may enable the underwriters to recoup their losses, albeit over a long period. Launch insurance premiums on policies issued this year have ranged from 16% to 20%, and recent quotes have been as high as 30% (in contrast, many of the satellites insured during the early 1980s were offered rates of under 8%). Given historical launch failure rates of 15%-20%, the industry's "exposure" is falling as the last of these low-rate satellites are launched. In addition, insurance underwriters are no longer willing to offer coverage predating a launch by a year or more. Current practice is to wait until 90 days prior to launch. Accordingly, most satellites launched during the next five years will probably be insured at rates that more nearly approximate the actual risk of loss.

The Space Insurance Industry

Historical Overview

The insurance community has been an active participant in the satellite communications industry for 20 years. The first insurance policy for satellites was written in 1965 to provide prelaunch coverage for Intelsat's "Early Bird" satellite. The Early Bird policy covered only third party liability risks and damage to the satellite prior to launch. However, after the loss of a satellite in 1968, Comsat approached aviation underwriters in an attempt to obtain a "launch insurance" policy covering any failure of its satellites to achieve proper orbit. The policy insured Comsat against the loss of one satellite in a five-launch series, and included a "deductible" of one launch failure.

In the 1970s, privately owned satellites were launched with increasing frequency, and insurers agreed to provide coverage as sufficient data on satellite reliability was amassed in order to calculate financial risk. The early policies typically covered a series of satellite launches over a period of years, and provided for a deductible of one or more satellite losses before the underwriters would be called on to pay a claim. This practice gradually changed in the mid-1970s and the industry dropped the requirement of deductibles and agreed to insure single launches. This change in practice facilitated the growth of satellite telecommunications entrepreneurs, but also planted the seeds for the industry's current predicament.

Types of Space Insurance Coverage

Communication satellites are not standardized products. Despite general similarities, each satellite, and indeed each launch vehicle, is tailored to the precise needs of the customer. Not surprisingly, insurance coverage requirements exhibit individual characteristics. As a result, each space insurance policy tends to be unique. Many different types of space coverage have evolved over the past two decades. **Policies that have been offered for satellites can be grouped into three general categories: property loss; business risk/lost profit; and third party liability.** Some underwriters have also offered astronaut life insurance policies, although this is still an evolving market.

Property Loss Insurance. A satellite is an extremely valuable piece of hardware. A typical C-Band communication satellite costs $40-$50 million, and a Direct Broadcast Satellite or an Intelsat VI class satellite can cost over $100 million. The cost of launch services to deliver a satellite to geosynchronous orbit can range from $15-$100 million, depending on the size of the satellite, the launch vehicle, and the upper stage used (if any). Damage to the satellite can occur in three different areas: on the ground, during the launch phase, and in orbit. Each of these potential loss regions has evolved a separate type of policy coverage:

Prelaunch insurance normally provides "all risks" coverage for satellites and associated equipment during the prelaunch phase. This includes construction, transportation from the manufacturer's premises to the launch site, launch site storage, final mating with an upper stage, and integration with the launch vehicle. This policy may also cover penalties imposed by launch agencies for delays caused by the satellite owner. Since the payload remains on the ground, risk is minimal and premiums for such insurance are typically of the same order of magnitude as other terrestrial property insurance. This insurance is often included in the price of the contract with the satellite manufacturer.

Figure 1: Differing Insurance Rates by Launch Vehicle

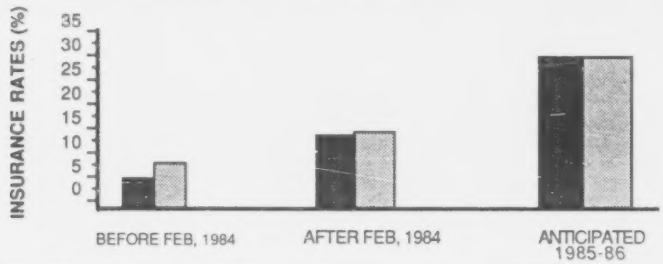


Figure 2: Annual Losses

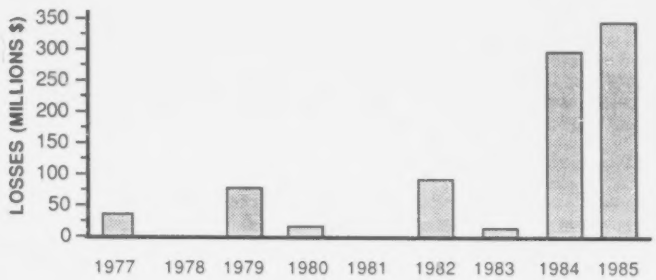


Figure 3: Cumulative Totals

Launch insurance covers the satellite payload from ignition of the launch system through the initial operation of the satellite in orbit. Launch insurance policies cover performance of the launch vehicle, the apogee kick motor and the upper stage motor, and the deployment and initial checkout and operation of the satellite. In addition, in September 1985 Intec announced that it would offer coverage for repair, rescue and jettison of satellites as a launch insurance option. Launch insurance coverage usually terminates 120-180 days after launch.

The launch phase is the highest risk portion of the satellite delivery process, and is accordingly the most costly to insure. Four satellite launch insurance policies were written in 1985 (Arabsat, Aussat, Brazilsat and Morelos) with premiums ranging from 16%-20%. Although no insurance policies have been written since the loss of Ariane V15 in September, the current market rate for launch insurance on any launch vehicle is in the range of 25%-30% of agreed insured value, judging by the level of recent quotes.

As shown in Figure 1, launch insurance rates historically have been dependent upon the launch vehicle. These differentials were based on the performance history of the vehicle and the perceived reliability of the technology involved. Some of the early Ariane launches were insured at rates double those applicable to Shuttle launches. Delta and Atlas launches also enjoyed lower rates than Ariane because of a history of several years of successful operations. The failures of two Shuttle-launched payloads in February 1984 led to a reduction in the differential between Ariane and the Shuttle, but the gap did not close entirely until the spring of 1985. At the present time, there is no substantial difference in rates quoted for different launch vehicles.

In-orbit insurance (also known as satellite life insurance) indemnifies the satellite system owner for loss sustained by the failure of a satellite to perform to specifications subsequent to attainment of its correct orbit and satisfactory initial operational status, as well as loss of fuel, power or transponders. Rates for life insurance have typically varied in the range of 1%-2% of insured value per year. However, in the wake of recent losses, life rates have risen to 4%-5% per year. This increase is not due to any adverse change in the record of performance in orbit, but rather is attributable to (a) the aging of the satellite population, implying that the premium base could be wiped out by one total failure, and (b) efforts by underwriters to recoup their satellite losses from all available sources.

Business Risk Insurance. This category of insurance covers satellite cash flows such as manufacturers' performance incentives, loss of revenue and business interruption for the transponder owner/lessee, and contingent loss of revenue and extra expenses caused by launch delays. Although such coverage presents substantial moral hazard problems, the insurance industry is apparently still willing to write such lines of coverage if requested by an owner or manufacturer.

Third Party Liability Insurance. Third party liability is the only type of space insurance required by law. Under the terms of a 1973 treaty (the Convention on Liability for Damage Caused by Space Objects), the U.S. government is absolutely liable for any damage caused by U.S. space objects to foreign nationals or property on the ground, or to aircraft in flight. U.S. space objects include both government and private payloads, as well as foreign payloads which are launched by the U.S. government or from U.S. territory. The U.S. is also liable under the treaty for damage caused in space to foreign space objects, but only if the U.S. is "at fault."

Accordingly, NASA requires each private and foreign payload launched in the U.S. to carry $500 million in liability insurance (the federal government insures the Shuttle and all government payloads), regardless of the launch vehicle used.

(Arianespace requires 400 million French francs in coverage, which is provided as part of the price of launch services.) Since Shuttle launches of multiple payloads would therefore require $1 billion or more in insurance, far beyond the capacity of the industry, NASA has agreed to allow payloads to share available capacity. In 1983 NASA signed a memorandum of understanding with Intec, pursuant to which Intec established a $750 million third party liability facility for each Shuttle launch. For a typical Delta-class communications satellite (occupying one quarter of the payload bay), the premium under the Intec policy is on the order of $100,000-$150,000.

Space Insurance Industry Structure

As is true for other areas of the insurance industry, there are three categories of participants in space insurance: brokers, underwriters, and the insured. The broker negotiates with the party seeking insurance, is responsible for the details of a given contract, and must seek coverage from the underwriting community. The underwriter assumes the actual financial liability for the insurance policy.

The majority of firms involved in space insurance have a background in the aviation or maritime insurance markets. Since more than half of all space insurance is placed with underwriters outside the U.S., primarily in London (Lloyd's), all U.S. brokers have at least a working relationship with a Lloyd's broker. The leading U.S. brokers and their London counterparts are:

U.S. Broker	London Broker
Alexander & Alexander*	Reed Stenhouse Marketing Ltd.
Corroon & Black/Inspace*	Crawley Warren & Co.
Frank B. Hall*	Leslie & Godwin Aviation & Sedgwick Aviation Ltd.
Johnson & Higgins	Willis Faber
Marsh & McClennan*	C.T. Bowring & Co.
Nausch, Hogan & Maurrey	Sedgwick Aviation Ltd.

* Denotes companies which are publicly traded.

Space insurance underwriting leadership is vested in a small number of firms. The principal underwriters include:

Name	Location	Background
AIG	New York	Aviation
AOA	Washington	Aviation
Ariel Syndicate	London	Aviation
Faugere & Jutheau	Paris	Aviation
Generali	Trieste	Aviation
Intec	Washington	Space
Merrett-Dixie Syndicate	London	Maritime
Munich Re	Munich	Aviation
La Reunion	Paris	Aviation
Sturge Syndicate	London	Nonmaritime
USAIG	New York	Aviation

The above firms account for about half of world capacity for satellite risks. The most active Lloyd's syndicates in underwriting space insurance are the Merrett-Dixie Syndicate and the Ariel Syndicate.

Within the past 20 months, underwriters that have withdrawn from space insurance include Orion Syndicate (Lloyd's), Stewart Smith (Lloyd's), and the Lexington Insurance Company (AIG). In addition, many companies in the London market are limiting the amount of capital they will invest in space launch insurance. For instance, General Accident, one of Britain's leading insurers, has placed a limit of 1% of its aviation fund as the maximum it will devote to space insurance.

In the U.S., Intec recently announced that it would selectively insure some launches but would not insure satellites during the in-orbit test and checkout period (the period between delivery into orbit and the 120-180 days during which the satellite is fully deployed and tested), and would no longer insure in-orbit performance of a satellite until after it has demonstrated it is performing properly and has been accepted by the owner.

Under Intec's new Shuttle insurance coverage, occurrences such as the motor failures of Westar VI, Palapa B-2 and Leasat 3 (all of which were either retrieved or repaired by the Shuttle) would result in a partial payment to the insured until it was demonstrated that the repaired satellite was a total loss.

Recent Developments

The problems of the space insurance industry can be summarized as follows: enormous losses have depleted reserves and resulted in a sharp reduction in insurance capacity. Since the first satellite launch policy was written, the industry has had cumulative net losses of approximately $500 million. The current space insurance loss ratio is approximately 200% (for every dollar of premium received, the industry has paid out two dollars in claims). Capacity has declined from a high in 1983 of $260 million to a current estimate of $70-$100 million. This is barely sufficient to fully insure one satellite. As shown in Table 1, the industry has incurred losses of $600 million over the past 20 months. This figure includes Indonesia's Palapa B2 and Western Union's Westar VI, which remain unsold despite their dramatic retrieval in November 1984. In addition to claims already paid, claims for the Anik D-2 satellite and Arabsat 1 have also been filed. Annual and cumulative losses are shown in Figures 2 and 3 on page 4.

The basic cause of the space insurance industry's current woes is that the industry systematically underpriced its product vis-a-vis the underlying risk of loss over an extended period of time. Although the number of insurable launches over the past 20 years has been too small to enable the industry to calculate risks through use of actuarial methods, it is possible to approximate the risk of failure by using historical launch data.

The average failure rate for civilian communication satellites of all designs and all launch vehicles for the past 20 years is approximately 18%. The average failure rate since 1977 is approximately 16%. Although selection of different time periods will lead to different figures, and an argument can be made that some launch vehicles are more reliable than others, the fact remains that there is no acceptable method of predicting system failure in advance. Indeed, it is open to question whether any mathematical or engineering methods exist that can accurately predict the likelihood of failure of a complex system, as demonstrated by the inadequacies of the nuclear power safety studies in the late 1970s.

In any event, it is generally agreed in the industry that if launch insurance premiums had been set at 16% for the past decade, the insurers would have at least broken even. Instead, from 1979 to the end of 1983, launch insurance premiums were consistently under 10% and fell as low as 5%-6% for some launches.

Table 1: Insured Value of Failed Satellites, 1977 to Present

YEAR	SATELLITE	LAUNCHER	INSURED VALUE $ M	REASON FOR FAILURE
1977	OTS - 1	DELTA 2914	34	DELTA VEHICLE
1979	SATCOM III	DELTA 3914	77	AKM
1980	AYAME 2	N - 1	15	AKM
1982	MARECS - B	ARIANE 1-V5	28	ARIANE 3rd STAGE
	SIRIO - 2	ARIANE 1-V3	-	ARIANE 3rd STAGE
	INSAT 1A	DELTA 3910/PAM	65	SATELLITE
1983	SATCOM II	N/A	8	SATELLITE
1984	WESTAR - 6	STS 41-B	106	PAM - D
	PALAPA - B2	STS 41-B	75	PAM - D
	INTELSAT V F-6	ATLAS CENTAUR	102	ATLAS CENTAUR VEHICLE
	ANIK - D2	STS 51-A	6	SATELLITE
1985	ARABSAT 1A	ARIANE 3	25	SATELLITE
	LEASAT 3	STS 51-D	85	SPACECRAFT
	LEASAT 4	STS 51-I	85	SPACECRAFT
	EUTELSAT ECS 3	ARIANE 3-V15	65	ARIANE 3rd STAGE
	SPACENET 3	ARIANE 3-V15	85	ARIANE 3rd STAGE
	LEASAT 2	STS	N/A	SATELLITE/ SPACECRAFT

Several factors may have contributed to erroneous risk assessments by the underwriters. Space is a new field, in terms of business risk as well as the technology experience needed to evaluate the inherent risks in rapidly evolving satellite and launch vehicle technologies. In addition, space insurance premiums are at least an order of magnitude greater than rates for most other forms of terrestrial property. During the high-inflation years of the late 1970s, when interest rates were high, some underwriters found it attractive to accept space insurance premium money in order to obtain investment returns.

A sound understanding of the technology involved is essential for prudent satellite underwriting. Accordingly, underwriters are now demanding much more detail on satellite design specifications before writing or renewing policies. Policies are becoming much more detailed, covering a shorter period of time, and compensate for actual rather than pre-agreed value. The tendency now is to base indemnification on financial loss sustained rather than loss of communications capacity.

Recent losses are not the only bad news facing the industry. The satellite population in orbit is aging, and manufacturers' initial estimates of satellite design lifetimes are proving to have been optimistic. Accordingly, in-orbit losses, partial and total, are expected to increase over the next decade.

The impact of recent satellite losses has been magnified by the enormous claims being filed on unrelated lines of insurance. Many underwriters that cover space accounts have been faced with heavy losses in their aviation accounts, as well as general business insurance for pharmaceuticals, product liability, malpractice and toxic chemicals, which have reduced the amount of funds available for space ventures. In response to the rash of claims, insurers are increasing premiums and reducing coverage, thereby aggravating a worldwide insurance capacity shortage estimated by Business Week at $62 billion over the next three years.

As we noted above, the outlook is cloudy at best. Higher rates may attract more capacity, but continued losses are likely to drive more underwriters out of the market. If this occurs, insurance rates are likely to rise still higher, thereby closing the satellite market to start-up firms that are unable to encounter depressed profits, since demand for communications services is relatively elastic (increased rates are more likely to be absorbed by the satellite firms than to be passed on to customers).

A more optimistic scenario posits that, barring further losses in the short term, a premium rate between 20%-25% will become the new standard. Underwriters and brokers note that given historical loss rates, recovery of past losses is unlikely to occur; however, these rates would allow the industry to operate profitably henceforth. Notably, some space insurance brokers believe that this is the highest rate that underwriters can charge and still attract business, and the lowest they will charge based on their recent loss experience.

Recent statements by some underwriters have assigned much of the blame for recent satellite losses to satellite manufacturers, especially Hughes. As the manufacturer of the Leasat series, three out of four of which have malfunctioned, Hughes undeniably needs to reexamine its design and quality control procedures, an examination which is now under way. Indeed, Hughes and RCA recently testified before Congress that they were willing to accept responsibility for the in-orbit performance of future generations of satellites by offering insurance.

Table 2: Incidents of Failure

DATE	SATELLITE	LAUNCHER	FAILURE CATEGORY STAGE				
			I	II	III	IV	V
FEB 12, 1963	SYNCOM I	THOR DELTA					
OCT 26, 1966	INTELSAT II	DELTA					
APR 6, 1967	ATS - 2	ATLAS AGENA					
AUG 10, 1968	ATS - 4	ATLAS CENTAUR					
SEP 18, 1968	INTELSAT III - F1	DELTA					
JUL 26, 1969	INTELSAT III - F5	DELTA					
AUG 12, 1969	ATS - 5	ATLAS CENTAUR					
JULY 23, 1970	INTELSAT III F-8	DELTA					
AUG 19, 1970	SKYNET - 2	DELTA					
JAN 18, 1974	SKYNET - 2A	DELTA					
FEB 20, 1975	INTELSAT IV F-6	ATLAS CENTAUR					
APR 20, 1977	GEOS - 1	DELTA					
SEP 13, 1977	OTS - 1	DELTA 2914					
SEP 29, 1977	INTELSAT IV A F5	ATLAS CENTAUR					
FEB 5, 1978	ECS - 1	N VEHICLE					
DEC 6, 1978	SATCOM 3	DELTA 3914					
FEB 22, 1980	AYAME 2	N VEHICLE					
APR 10, 1982	INSAT 1A	DELTA 3910 PAM					
SEP 13, 1982	MARECS - B	ARIANE I-L5					
SEP 15, 1982	SIRIO - 2	ARIANE I-L5					
APR 4, 1983	TDRS - 1	STS-IUS					
JUN15, 1983	OSCAR - 10	ARIANE					
FEB 4, 1984	WESTAR - 6	STS-PAM-D					
FEB 5, 1984	PALAPA - B2	STS-PAM-D					
JUN 9, 1984	INTELSAT V F-9	ATLAS CENTAUR					
FEB 8, 1985	ARABSAT 1A	ARIANE 3					
MAR 8, 1985	ANIK - D2	STS-PAM D					
APR 12, 1985	LEASAT 3	STS-MINUTEMAN					
AUG 28, 1985	LEASAT 4	STS-MINUTEMAN					
SEP 12, 1985	ECS 3	ARIANE 3 -V15					
SEP 12, 1985	SPACENET 3	ARIANE 3 -V15					
SEP 25, 1985	LEASAT 2	STS-MINUTEMAN					
TOTAL			5	11	10	3	3

LEGEND:
I - INITIAL STAGE II - UPPER STAGE III - APOGEE KICK MOTOR IV - SPACECRAFT V - SATELLITE

However, it should be noted that if manufacturers self-insure satellites, this wil have the effect of reducing the need for market insurance, reducing premium revenue and making it more difficult for the insurance industry to pay off the recent losses. Thus, it is not clear that it is in the interest of underwriters t abdicate this portion of the market to manufacturers.

Moreover, as shown in Table 2, the primary cause of satellite losses (and the claims paid by underwriters) has been launch vehicle malfunctions. Of the 30 civilian communications satellite malfunctions to date, 24 have been related to launch systems. Launch vehicle manufacturers have traditionally declined to provide warranties of any sort for the performance of upper stage motors or launch vehicles. This practice may change as a result of pressure from the insurance industry. However, launch vehicle makers are not likely to self-insure, and if they accept responsibility for failures and insure their risk, this will not alleviate the strain on the already-overburdened space insurance market. Entrepreneurial launch vehicle firms such as Transpace Carriers Inc. (Delta) and Orbital Sciences Corp. (upper stage) cannot afford to self-insure, and would have to obtain insurance; the only difference would be which pocket pays the launch insurance premium. Thus it appears that the best solution is for manufacturers to improve the reliability of their vehicles.

Resolving the Insurance Crisis

The most immediate change in the present pattern of space insurance underwriting brought about by recent losses is the dramatic increase in rates over those that prevailed less than two years ago. As noted above, launch premium rates currently are in the range of 25%-30% of the sum insured, compared with 6%-8% in the fall of 1983, and there is every reason to believe that rates will remain above 20% for the next several years. History may repeat itself. Growth of insurance capacity in the early 1980s was due to new entrants attracted by then-historically-high rates (8%-10%) prevailing in the late 1970s. Underwriters are also learning to protect themselves from changes in the market. Some recent policies do not insure a series of launches at a fixed price, but cover each one on an individual basis. In that way, the premium can be adjusted to reflect any problems with a previous launch.

Higher premiums could attract more insurers into the field of satellite launch coverage. Michael Hewins of Johnson & Higgins recently testified before Congress that if all presently uninsured satellites scheduled for launch through the end of 1987 were insured at premiums of 30%, and assuming insurance capacity was $100 million per launch, total insurance premium revenue received would be approximately $900 million. Even if losses continue, an average premium rate of 16% will enable the industry to recoup about one-third of its $600 million in recent losses. However, if new entrants depress rates, as happened after the loss of RCA's Satcom in 1979, the industry will simply be primed for another disaster. In short, the future of the industry depends on underwriters' long-term judgment prevailing over short-term cash flow demands.

In order to limit underwriters' exposure, the insurance industry is considering many alternatives, including returning to earlier practices such as a one-satellite deductible in a series of insured launches, indemnification for partial losses, and restricting coverage to the "less risky" phases of launch operations. One possible option is to segregate launch insurance into distinct categories, so that the risk of failure of the upper stage booster could be insured separately from the other parts of the launch system. However, there is little sentiment in the insurance industry for such a concept and most satellite owners would prefer to insure the total transportation risk as a package.

Another alternative is self-insurance, i.e., the transfer of some or all risk to the satellite owner. However, the financial risks of self-insurance are enormous and few satellite owners would be willing and able to take such risk. A start-up firm would not have sufficient financial resources and could not survive a self-insured loss on its own. The problem with self-insurance for large publicly-traded companies is not simply whether a firm's assets can support the loss of a $100 million satellite; rather, the issue is the impact of such a loss on earnings and the effect of such a loss on the company's stock price.

A concept similar to self-insurance is co-insurance, in which a policy could be written so that the owner of the spacecraft would be indemnified for only a percentage of the payload. If the launch were unsuccessful, the underwriters and owners would both lose, giving both parties a more equal stake in the success of the launch. A co-insurance policy could also be drafted to make the manufacturer of the failed hardware liable for losses, and to require the end-user of satellite services to absorb some risk as well.

If some or all of the above proposals are implemented, however, they could thwart the development of a competitive space industry by squeezing out smaller firms that require property loss coverage and cannot self-insure. In addition, reducing the amount of insurance written would prevent insurers from recouping their losses quickly through premium revenues.

NASA's Relaunch Policy

Traditionally NASA has offered a free reflight option to customers whose satellite malfunctioned because of the performance of the Shuttle. In October 1985, NASA announced a new policy for relaunching satellite payloads. In addition to the existing free relaunch option, the new policy offers a relaunch at 50% of full price for any satellite that fails within the first 90 days, regardless of cause. (NASA claims that at 50% of full price the customer pays the marginal cost of the flight, so there is no taxpayer subsidy involved.) The one stipulation is that the customer must choose the option before launch. The new policy is designed to reduce the impact of anticipated higher insurance rates and enable the Shuttle to remain competitive with Arianespace, which has recently offered a free relaunch or compensation through its newly-organized self-insurance plan. If Ariane can successfully organize its self-insurance program and provide coverage at rate of 11%-13%, it could make its already competitive position vis-a-vis the Shuttle even more attractive.

A major drawback of the new NASA policy is that it will reduce insurance premium revenue, because satellite owners will have to insure only 50% of the cost of a second Shuttle launch. This feature has drawn criticism from underwriters, and the possibility that the 50% discount policy may actually be a subsidy has attracted close congressional scrutiny.

Government as Insurer of Last Resort

Several proposals have been made for the U.S. government to act as a satellite insurer of last resort. RCA and others have proposed the formation of a temporary insurance pool administered by a government agency that would offer launch insurance at rates above the prevailing market rate. The purpose of such a pool would be to guarantee that commercial space development, and usage of the Shuttle for launching multiple payloads, would not be adversely affected by a lack of insurance capacity. Conceivably the government might accept a role as insurer of last resort if there was a consensus that without such government participation, vital space policy goals

would be threatened. However, both NASA and the Department of Transportation recently testified against such a government role, which also has been opposed by most insurance brokers, underwriters and satellite owners. Thus, it is apparent that a consensus does not now exist.

The U.S. government already plays a role in insurance, but in the field of third party liability insurance, not property loss. NASA indemnifies small Shuttle payloads for third party liability risks and requires all Shuttle payloads to enter into a cross waiver of liability. Thus, Shuttle users are protected from claims for damage brought by other payload owners. Some insurers and satellite owners have proposed an increased role for NASA in safety and reliability testing and dissemination of technical data to the insurers. However, NASA does not have the spare resources to fill those roles, and Congress is unlikely to appropriate additional funds for such purposes, although NASA is willing to assist wherever possible.

In short, while precedents exist for government involvement in insurance, there are few strong arguments for it in the U.S. Government participation could undermine the commercial development of space, adding levels of complexity and cost, and distorting the functioning of the space insurance market. In the present political and budgetary climate, U.S. government participation in the insurance industry is not considered likely, barring further major losses and a collapse of the market.

Satellite Repair and Retrieval

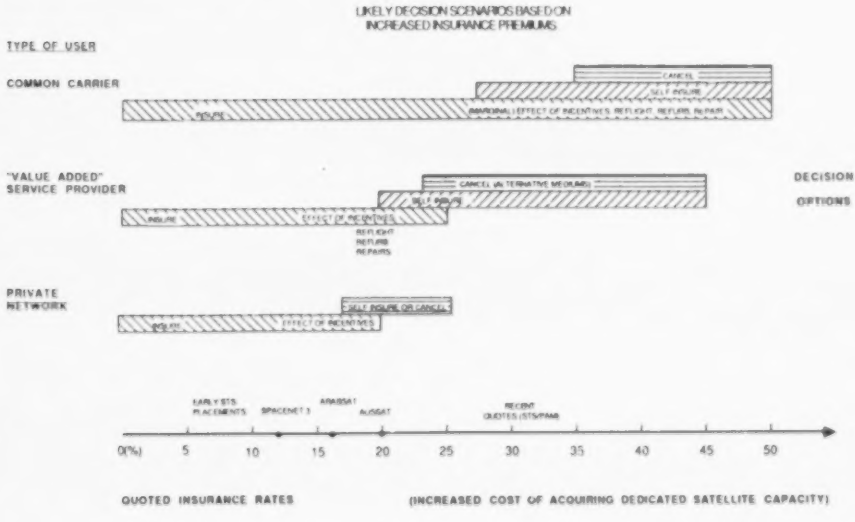
The Shuttle's unique advantage over all other existing launch vehicles is that it is both manned and reusable. This makes it possible to rescue and repair satellites in orbit. Future spacecraft are being designed to facilitate servicing operations in orbit. Hughes has stated that it will design in-orbit repair capabilities into future generations of spacecraft, taking into account the Shuttle's ability to service spacecraft in orbit for both planned and contingency operations. In addition, Intec recently announced that it would offer as a launch insurance option, coverage for repair, rescue and jettison of satellites.

In terms of future insurance policies, however, retrieval and repair missions are of relatively minor importance, since most satellites tend to malfunction in orbits that the Shuttle cannot reach. For example, Palapa's and Westar's upper stage malfunctions happened to place the spacecraft in accessible orbits, but could easily have left them in inaccessible orbit. Unfortunately for the underwriters who now own the Palapa and Westar satellites, the current glut of C-Band transponders has made disposal a difficult problem. The satellites remain unsold, and storage costs are on the order of $100,000 per month. Therefore, despite the apparently successful repair of Leasat 3 in August 1985, retrieval and repair are not likely to have a major impact on insurance rates or capacity for some time. The only immediate effect of the successful rescue and repair missions to date has been to compel underwriters to introduce language concerning satellite ownership and salvage rights into insurance policies.

Table 3: Types of Satellite Service Providers and Users

TYPE	PRINCIPAL BUSINESS	EXAMPLE	RELATIVE IMPACT OF LOSS OF DEDICATED SATELLITE CAPACITY
COMMON CARRIERS: SPECIALIZED COMMON CARRIERS	PROVIDE SATELLITE CAPACITY TO COMMUNICATIONS USERS	RCA AMERICOM WESTERN UNION COMSAT GENERAL	HIGH; IF A SATELLITE IS HEAVILY COMMITTED TO TRANSPONDER USERS, IMPACT OF LOSS TO CARRIER IS POTENTIALLY DISASTROUS
"VALUE ADDED" SERVICE PROVIDERS: SATELLITE OWNERS	PROVIDE SERVICES USING DEDICATED SATELLITES	FEDERAL EXPRESS GTE SPACENET (SPRINT) FORD AEROSPACE SATELLITE SERVICES	MODERATE TO HIGH; PRINCIPAL REVENUE IS DERIVED FROM A PRODUCT OR SERVICE WHICH USES SATELLITE CAPACITY BUT MAY NOT BE DEPENDENT ON ANY GIVEN SATELLITE. IMPACT BASED ON AMOUNT (VOLUME) OF DATACOM REQUIREMENT AND MARKET AVAILABILITY OF ALTERNATE SATELLITE CAPACITY.
"VALUE ADDED" SERVICE PROVIDERS: TRANSPONDER LESSORS	LEASE SATELLITE CAPACITY FOR PRIVATE NETWORK OR SERVICE	U.S.A. TODAY NBC HBO HOLIDAY INN	LOW TO MODERATE; LIKE "VALUE ADDED" SATELLITE OWNERS, THE LESSORS HAVE THE FLEXIBILITY TO SHIFT TO ALTERNATIVE SATELLITE CAPACITY OR OTHER TRANSMISSION MEDIA , DEPENDING ON THE AVAILABILITY, INVESTMENT IN GROUND SEGMENT, AND VOLUME.IMPACT IS ON COST OF DOING BUSINESS, NOT ON THE BUSINESS ITSELF.

Figure 4: Potential Effects of Increasing Insurance Costs on the Satellite User Community



Satellite Industry Financial Implications

The above discussion has focused on possible modifications that insurers may employ to restructure the satellite insurance industry. Essential to any successful proposal is the need for insurers to fully consider how a restructuring might affect the future composition and size of the satellite services user community.

Any contraction in the markets for insurance and financing would make it more difficult for smaller firms to compete in the industry, and might preclude entrepreneurial firms from entering the communications satellite arena. Financing for new satellite systems becomes a major problem in the absence of adequate insurance, especially for entrepreneurial satellite companies. Entrepreneurs are already disadvantaged, having basic business risks to cope with in addition to technical and insurance risks. Unable to self-insure, these companies may be forced to ask backers to assume the risk of launch and in-orbit failures. This is a request that the financial community is certain to refuse.

The financial impact of higher insurance rates or self-insurance requirements is likely to be different on different types of satellite users. Common carriers and many value-added network operators have made large capital investments in construction, launch and operation of satellite systems and in associated earth station networks. Thus, they cannot switch quickly to other modes of telecommunications without economic dislocation. Accordingly, they are less likely than pure consumers in the short term to abandon or reduce the use of satellites because of the cost or availability of insurance. In economic terms, their satellite demand is relatively inelastic with respect to insurance. Nevertheless, since consumers of their services usually have alternatives for communications services, "derivative demand" is relatively elastic. This implies that increased costs associated with higher premiums or self-insurance are likely to be absorbed, at least in part, by the carriers.

By contrast, firms that merely lease transponders for use in private network systems, although favorably disposed toward satellites as their transmission medium of choice, enjoy greater latitude to switch to an alternative terrestrial transmission system. These companies are more likely to consider substituting fiber optics and terrestrial microwave circuits for satellites if the costs of satellite transponders rise sharply due to higher insurance rates or lower insurance capacity. Table 3 summarizes the characteristics of the different user types. As the satellite industry matures, these distinctions will blur.

Figure 4 summarizes the likely effects of increasing insurance premiums (and, therefore, overall satellite system cost) on each of the different types of satellite system operators and users. The model depicts three insurance decision plateaus for the system operator: namely, to insure, to self-insure, and to cancel a satellite program based on high cost or the availability of alternate capacity (either leased circuits or terrestrial systems). The breakpoints for each of these decisions are determined by the characteristics of the operator's business, the operator's financial resources, and the operator's transmission volume requirements.

Within the operator categories (it should be noted that the distinctions among these categories are blurring as common carriers become more specialized and value- added operators sell off excess capacity), it is assumed that the common carrier has the least flexibility. The common carrier is wedded to the satellite program. If a carrier's satellite is heavily committed before launch, no package of reflight,

repair or refurbishment options can reduce the real impact of coverage at the maximum value possible. If the market cannot provide, the carrier must self-insure. The heavily committed common carrier should be the least receptive to the reflight, refurbishment, and repair incentive programs being offered by launch service providers.

On the other hand, the value-added service provider has greater flexibility. If satellite power or volume capabilities do not fix the value-added operator to a particular spacecraft, then the operator may be able to lessen the impact of higher insurance rates by reducing his coverage, accepting incentive packages, or by simply choosing an alternate source of transmission capacity.

At the far end of the spectrum, the satellite lessor has the greatest flexibility of users in a high-premium environment. The lessor may choose an operational satellite in-orbit for his capacity, may bargain for reduced cost in exchange for signing a preflight contract (and accepting insurance cost), or may take advantage of preemptive versus non preemptive pricing schemes for transponders.

In sum, there are options available to the various classes of satellite operators and users, even in a high-premium environment. But the real impact of the costly insurance market is on the satellite industry itself. The increased aggregate cost of satellite capacity only retards the development and use of the medium as a whole.

Impact on NASA and Arianespace

The primary launching organizations for satellites in the Free World, NASA and Arianespace/ESA, also face financial risks growing out of the insurance industry crisis. One possible financial risk is that the U.S. government (or Arianespace or ESA or France) will be called on to serve as insurer of last resort, which could lead to massive crash liabilities. However, as noted above, this does not appear likely at the present time, at least in the U.S. A more subtle financial impact on launch service providers would result from a decline in demand for such services resulting from lack of launch insurance capacity.

Although NASA claims that no launches to date have been postponed or cancelled for lack of insurance, Arianespace was forced to reschedule the launch of two GTE satellites in March 1985 because of lack of insurance capacity. The Shuttle in particular is at risk, since its primary advantage is the ability to deliver multiple satellites on each flight. If the capacity of the insurance industry does not recover, the Shuttle may not be able to attract multiple launches. However, since the Ariane III and IV vehicles rely on dual launches for economies of scale, it is difficult to predict how the decline in capacity will affect the relative competitiveness of Ariane and Shuttle. Single-payload launch vehicles such as Delta and Atlas could become slightly more attractive, although it is unclear at this point whether this advantage would overcome the higher launch price associated with these vehicles.

Impact on Other Commercial Space Activities

Although communication satellites are the largest commercial space industry to date, other commercial space ventures are on the horizon. Entrepreneurs are considering ways to profitable exploit the space regime of the low earth orbit (see the January and May 1985 issues of SPACE). Since most of these new commercial space ventures will be launched on the Shuttle, and many will never leave the Shuttle, catastrophic launch risk will be minimal and insurance should not present a major obstacle to financing for such ventures.

Free Flyers in LEO. Several commercial projects have been proposed for operation in LEO, including the Fairchild Leasecraft, the ESA Eureca platform, the MBB SPAS platform, the Space Industries Inc. Industrial Space Facility (ISF), and the Astrotech electric utility platform. All would be launched by the Shuttle and remain in orbit either indefinitely or for several months at a time. They would be serviced and resupplied by the Shuttle. Accordingly, their risk of total catastrophic loss is relatively low compared with a communication satellite in geosynchronous orbit, so insurance should not be difficult to obtain or particularly expensive relative to satellite insurance.

As evidence of this, the only commercial LEO payload flown to date, the Shuttle Pallet Satellite (SPAS) owned by Messerschmitt-Boelkow-Blohm (MBB) and flown in 1983, was insured for a premium well below the prevailing satellite launch insurance rate. Although Space Industries recently testified before Congress that it believed that the ISF could not obtain insurance and that this would complicate financing efforts, this statement may be more a reflection of the current stage of project development (and the corresponding reticence of insurers to quote rates) than a final position of the insurance industry.

Shuttle-Based Commercial Projects. The safest place in space today is on the Shuttle itself. As a man-rated vehicle, it meets the toughest reliability standards. Accordingly, the risk of loss associated with ventures carried out on the Shuttle is low, and such ventures should have correspondingly low insurance costs. Space manufacturing or processing operations, like the McDonnell Douglas electrophoresis program, and Shuttle equipment storage and experiment facilities such as the Spacehab pressurized module and the Teledyne Brown experiment carrier, should have no difficulty obtaining casualty loss insurance, even in the present market situation.

Remote Sensing Service. With the transfer of Landsat to the Earth Observation Satellite Corporation (EOSAT) in July 1985, and the imminent launch of SPOT, the quasi-private French remote sensing satellite system, in January 1986, private sector remote sensing is a reality. However, obtaining insurance for private remote-sensing satellites is likely to be difficult to obtain, although capacity is not likely to be a major problem.

Remote-sensing satellites may be difficult to insure because they are quite complex, and limited experience with the Landsat series has shown that they are subject to failure. On the other hand, since the satellites operate in orbits just above Shuttle orbit (albeit in polar inclinations), they could be designed to automatically lower their orbits for Shuttle rendezvous. However, this is still a relatively untried technology that is not likely to be insurable until several successful tests have occurred.

Lack of insurance is not likely to deter development of the remote-sensing market because the principal "private" firms, EOSAT and SPOT, will both be heavily subsidized by their respective governments. The size of the remote-sensing data market is more problematic than insurance, and the presence of subsidized government competition will deter additional private sector entry. (See the June 1985 issue of SPACE.)

Technology Implications

The size and frequency of recent satellite losses has made insurers suspicious of new technologies. Therefore, future new satellite designs will not enjoy the levels of insurance support awarded to more conservative or technically proven designs. Insurers will insist on more tests and even demonstration flights before agreeing to provide insurance. This will have an impact on firms that are developing state of the art Ka-band, Ku-band and hybrid satellites, notably Hughes, Ford and RCA, and firms that intend to purchase such satellites. In the future, sale of a new technology to a government will be critical to obtaining insurance for subsequent private sales.

Another possible consequence of recent losses is that limited capacity will force satellites to be designed to fit available insurance capacity, i.e., smaller and less costly satellites with fewer transponders. The drawback to developing larger numbers of small satellites is the rapidly shrinking available space in geosynchronous orbit. However, for a few years, the small-satellite strategy might work if the current transponder glut were to endure. The impact of this trend, if it materializes, would be to render giant satellites such as the 54-transponder Fordsats virtually uninsurable (or only partially insurable). Even organizations such as Intelsat, which could afford to purchase satellites as large as the Intelsat VI class, would be forced to reassess their plans, given the present climate. Satellite manufacturers could find that their investment in large satellites had become temporarily worthless in the commercial market, and would be forced to engage in a costly redesign process. It is too early to tell if insurance capacity will remain low long enough to have such a design impact, but the risk is present.

Conclusions

The space insurance industry has been battered by $600 million in claims on satellite losses over the past 20 months. Capacity has dropped to an estimated $70-$100 million, barely sufficient to cover one satellite, and rates are in the range of 25%-30%. Underwriters have lost confidence in the ability of satellite, upper stage, and launch vehicle manufacturers to build reliable products, and this confidence can only be restored over time. Although government intervention as an insurer of last resort has been proposed, the idea has attracted little support and is not likely to be adopted.

The impact of higher rates and lower capacity probably will be felt most severely by small, entrepreneurial firms attempting to enter the telecommunications market. These companies are too small and thinly capitalized to afford self-insurance and in effect are unable to obtain financing without insurance. Many could be forced to defer plans to launch satellites, or to drop out of the market entirely. Larger established telecommunications firms will react to the insurance situation differently, depending on how integral satellites are to their operations. Some firms, especially private networks that can use other telecommunications methods, may switch from satellite transponders to terrestrial methods.

Satellite and launch vehicle manufacturers can expect demands from insurers to provide warranties or insurance on performance of their products, thereby increasing financial exposure. Demand for satellite-related products may also decline, although the length of the procurement cycle (more than three years) will preclude any appearance of a decline in near-term sales. It should be noted, however, that some of the decline in sales may be attributable to the current satellite transponder overcapacity problem rather than the insurance problem. Finally, launch service providers such as NASA and Arianespace may face a decline in launch revenues due to fewer launches and lost revenues from their respective relaunch policies.

However, commercial space entrepreneurs whose equipment is designed for operation in LEO should not be as adversely affected by the insurance crisis as the satellite telecommunications industry. With the exception of remote sensing, which enjoys substantial governmental support anyway, the lower risks of operating on the Shuttle (or in an orbit serviceable by the Shuttle) will enable such projects to obtain the necessary insurance at rates below those paid for communications satellites.

Calendar of Space Events

November	
18-19	"Space: Commercial Benefits for Industries Worldwide." The Financial Times International Conference, Minister House, Arthur Street, London, England. For information, call 01-868-4466.
19	"Space Expectations," Second Annual Space Symposium, U.S. Space Foundation, Colorado Springs, Colorado.
26	Scheduled launch date for STS flight 61-B. Major payloads: EASE/ACCESS, MORELOS-B, Satcom KU-2, and AUSSAT-2.
December	
3-4	Satellite Communications International Communications and Broadcasting Conference (Online International Ltd., 989 Avenue of the Americas, New York, NY 10018. For information, call (212) 279-8890.
4-5	World Telecommunications Conference (Financial Times International Conference, Minister House, Arthur Street, London, England). For information, call 01-868-4466.
18	Scheduled launch date for STS flight 61-C. Major payloads: Satcom KU-1, Westar 7, G-Star-C.
January	
11	Scheduled launch date for Ariane flight V16. Major payloads include SPOT-1 (French remote-sensing satellite) and Viking, a Swedish satellite.
15-17	Second Annual International Business in Space Conference, sponsored by The Center For Space Policy, Inc. at the J. W. Marriott Hotel in Washington, D.C. For more information, call (617) 576-2828.

Note: The December 1985 issue of **SPACE** will discuss the newly-formed GM/Hughes Electronics Corp. (GMHW).

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